US006308929B1

(12) **United States Patent**
Wieder

(10) **Patent No.: US 6,308,929 B1**
(45) **Date of Patent: Oct. 30, 2001**

(54) **MOLD INSERT**

(76) Inventor: **Klaus A. Wieder**, W3877 Scheel La., Helenville, WI (US) 53137

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/177,267**

(22) Filed: **Oct. 22, 1998**

(51) **Int. Cl.**[7] **B41B 11/62**
(52) **U.S. Cl.** **249/103**; 249/104; 425/577
(58) **Field of Search** 249/103, 104; 425/572, 577, 556, 588; 264/334

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,137,962	*	2/1979	Pol	164/236
4,280,976	*	7/1981	von Holdt	264/152
4,337,027		6/1982	Montieth	425/562
4,384,702	*	5/1983	Boskovic	249/103
4,708,314	*	11/1987	Kuhling	249/103
4,842,508	*	6/1989	Boskovic	425/468
4,909,725		3/1990	Ward	425/562
4,952,132		8/1990	Lundquist	425/197
5,097,864		3/1992	Myers et al.	137/528
5,151,282		9/1992	Dray	425/562
5,208,053	*	5/1993	Vandenberg	425/572
5,304,058		4/1994	Gill	425/562
5,421,716		6/1995	Gellert	425/549
5,435,023	*	7/1995	Wagner et al.	5/270
5,620,716	*	4/1997	Opitz	425/169
5,788,872	*	8/1998	Uratani	249/103
5,817,349	*	10/1998	Pruna	425/542
5,824,350	*	10/1998	Wietrzynski	425/190
5,902,512	*	5/1999	Streit	249/103

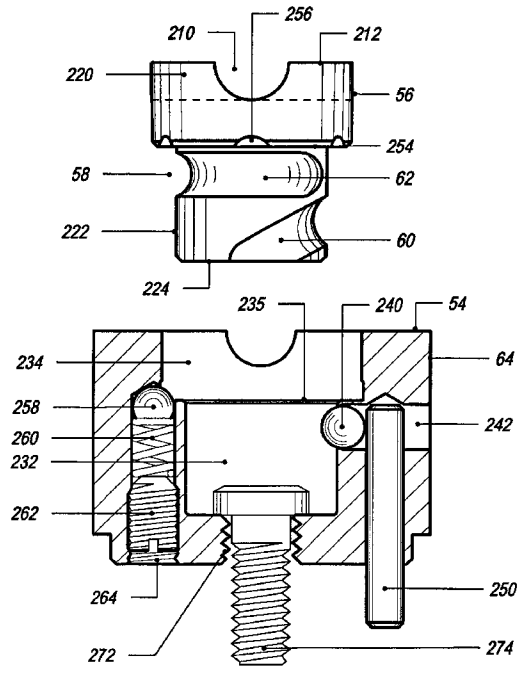
* cited by examiner

Primary Examiner—Nam Nguyen
Assistant Examiner—Emmanuel S. Luk
(74) *Attorney, Agent, or Firm*—Boyle Fredrickson Newholm Stein & Gratz S.C.

(57) **ABSTRACT**

An insert for a mold comprising a plug, having an insert face, and a receiver defined by a sidewall with one of the plug and the receiver having a groove that receives a guide that extends from the other of the plug and the receiver so as to facilitate rotation of the plug while opposing withdrawal of the plug. In one preferred embodiment, the groove has an inclined entranceway, that facilitates plug insertion and removal, and a transverse portion and extends circumferentially no more than about one and one-quarter rotation about the plug. In another embodiment, the guide is resiliently urged outwardly from the plug to ride in a groove in the sidewall and the sidewall has an access port for prying free the plug from the receiver. A detent assembly comprised of notches on the plug and a detent carried by the receiver permit the plug to be selectively indexed. The insert can be mounted to or carried by an ejector pin having a head constructed and arranged to prevent rotation of the pin during mold operation. In one preferred pin, a portion of the barrel is machined and hardened before shipment to another location, typically to an end user, where the unmachined portion is cut to length before machining the head and remainder of the barrel.

57 Claims, 12 Drawing Sheets



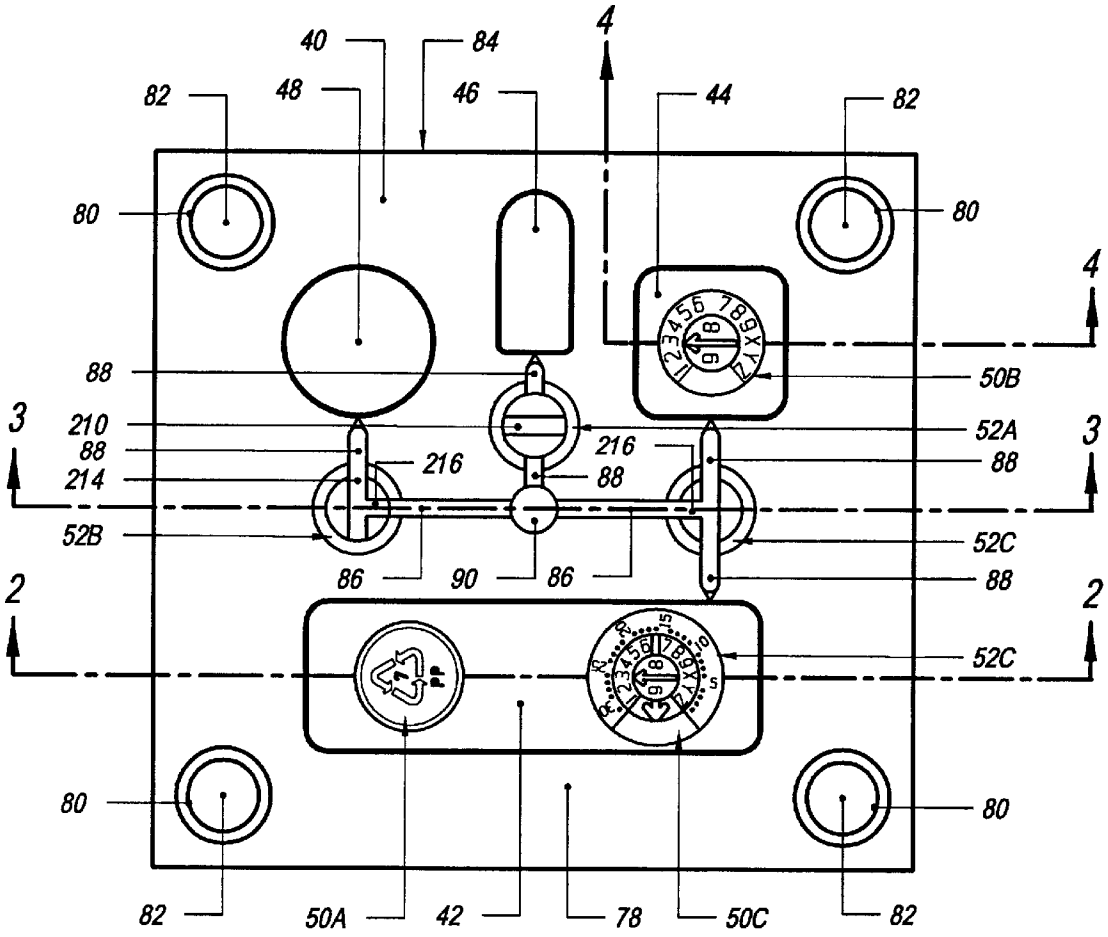

40
84
4
82
48
46
44
82
80
80
4
88
50B
3
210
52A
3
88
216
216
88
88
214
52B
52C
86
90
86
88
2
2
52C
80
80
82
50A
42
78
50C
82

FIG. 1

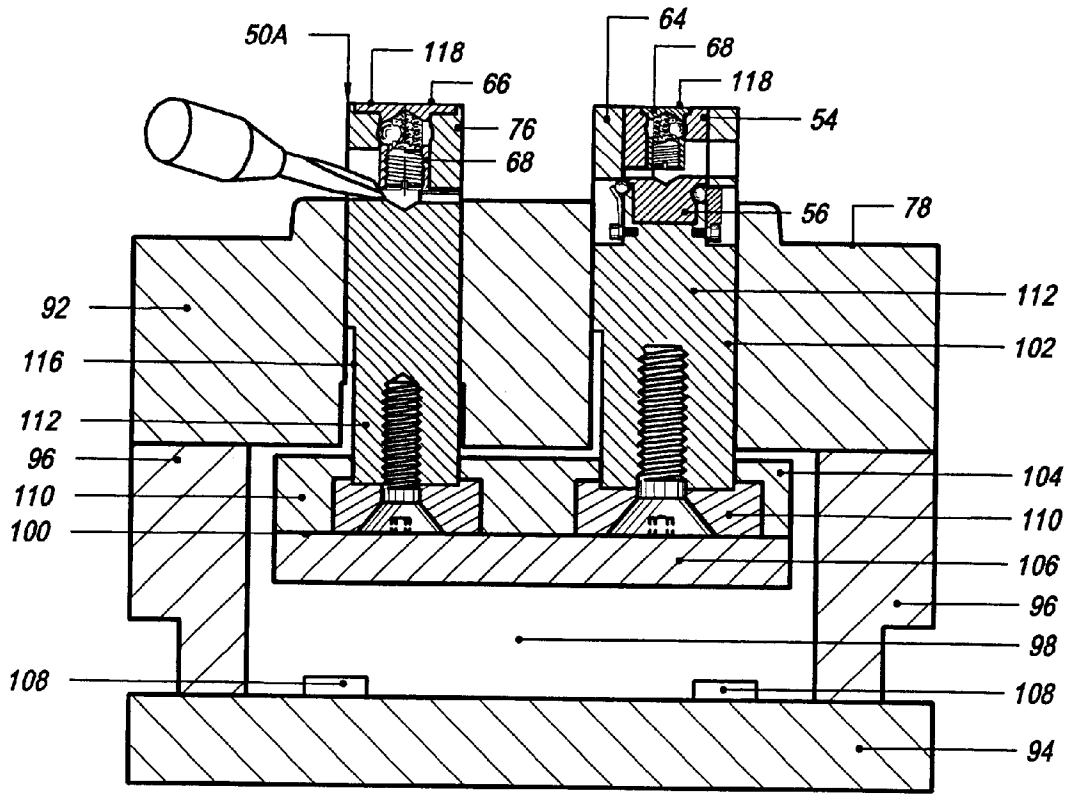

50A
118
66
64
68
118
54
76
68
56
78
92
112
116
102
112
96
104
110
110
100
106
96
98
108
108
94

FIG. 2

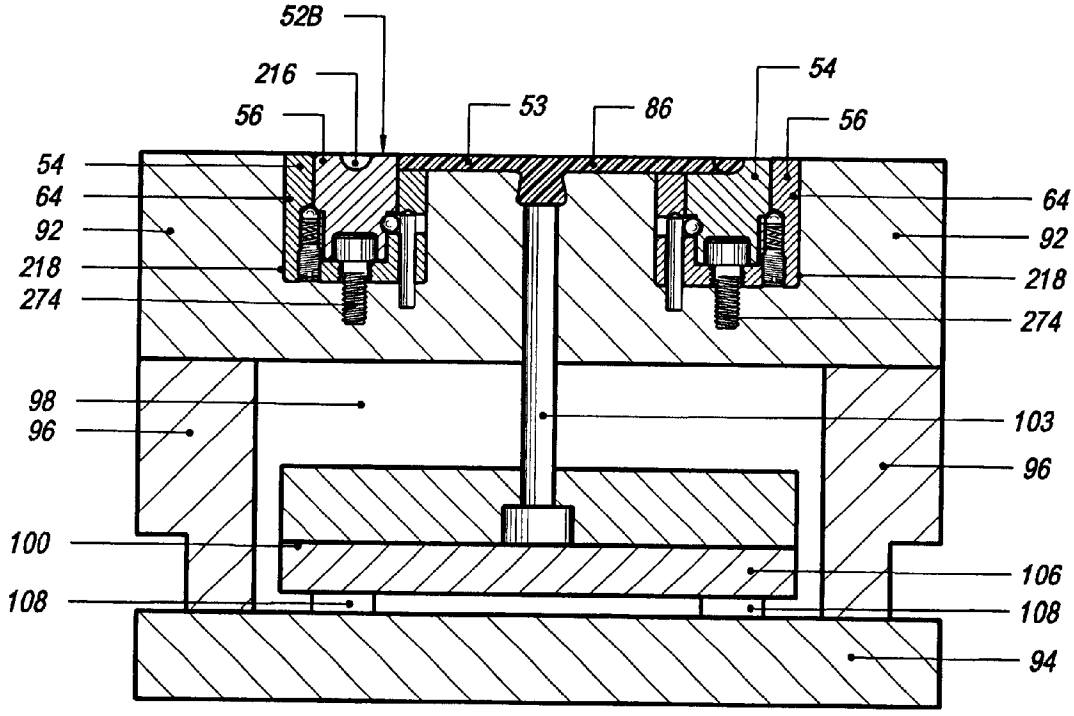

52B
216
56
53
86
54
56
54
64
92
218
274
64
92
218
274
98
96
103
96
100
106
108
108
94

FIG. 3

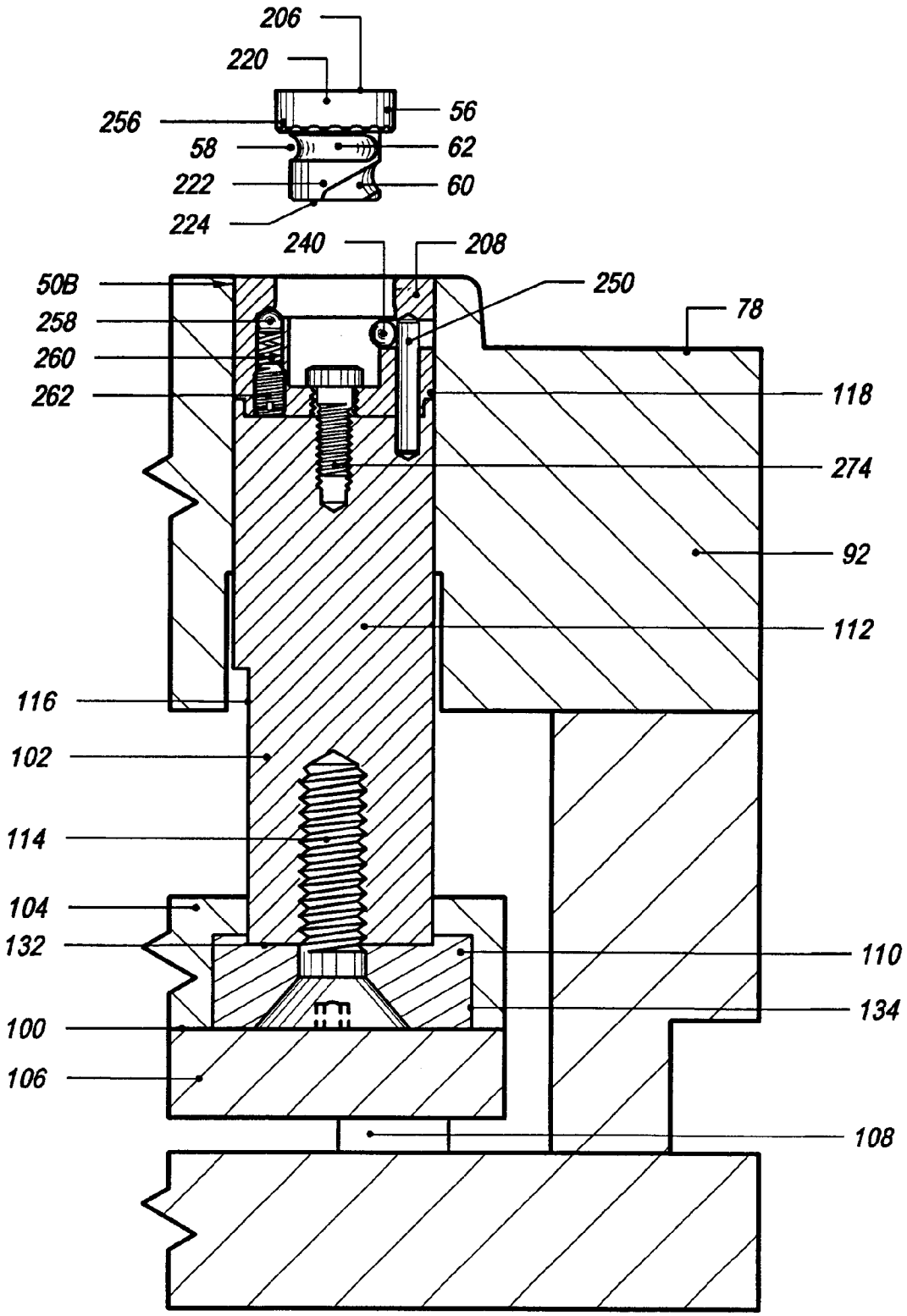
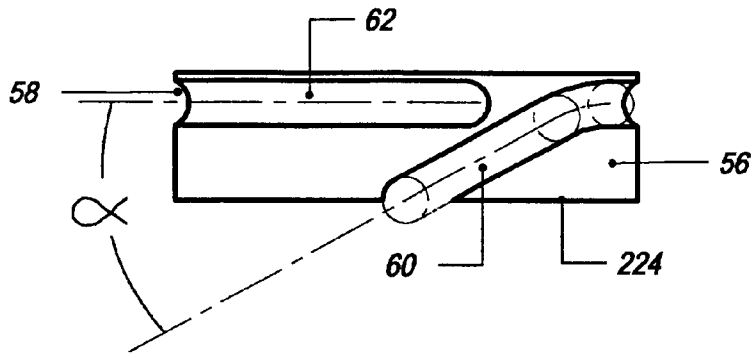

206
220
256
56
58
62
222
60
224
240
208
50B
250
258
78
260
262
118
274
92
112
116
102
114
104
132
110
134
100
106
108

FIG. 4

FIG. 6


62
58
56
60
224

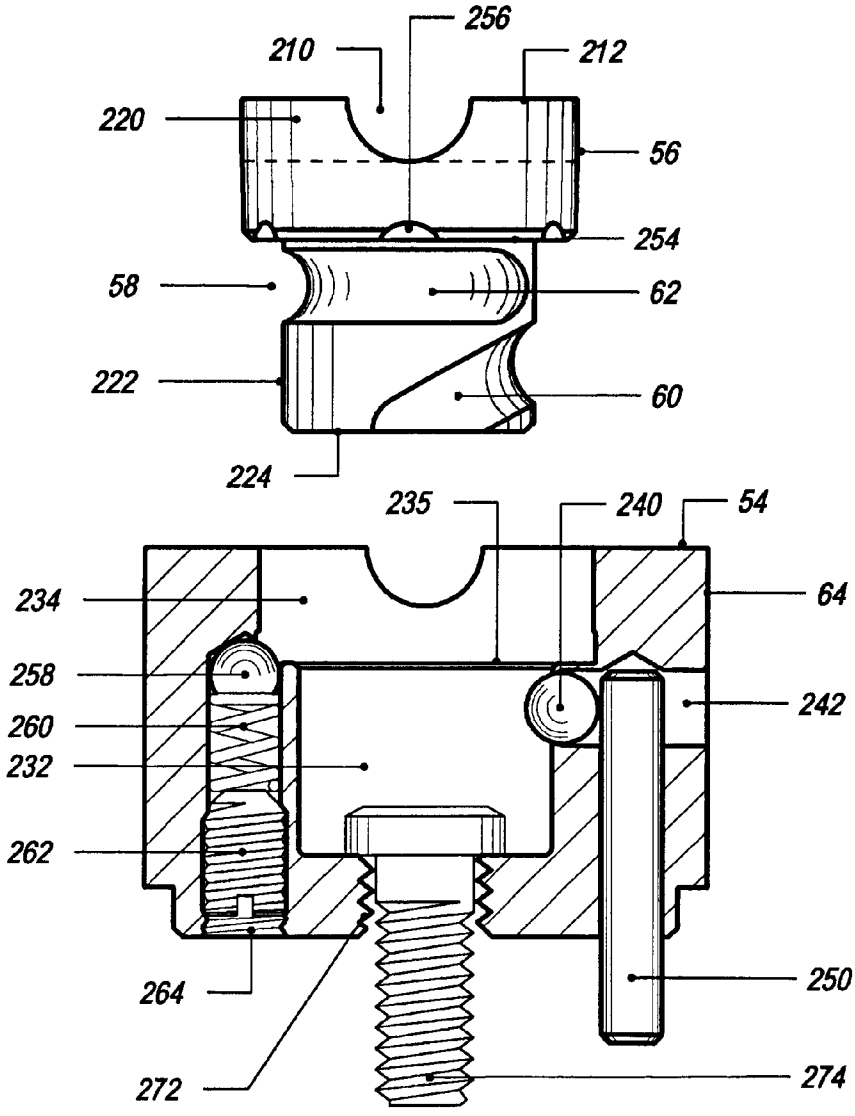

256
210
212
220
56
254
58
62
222
60
224
235
240
54
234
64
258
242
260
232
262
264
250
272
274

FIG. 5

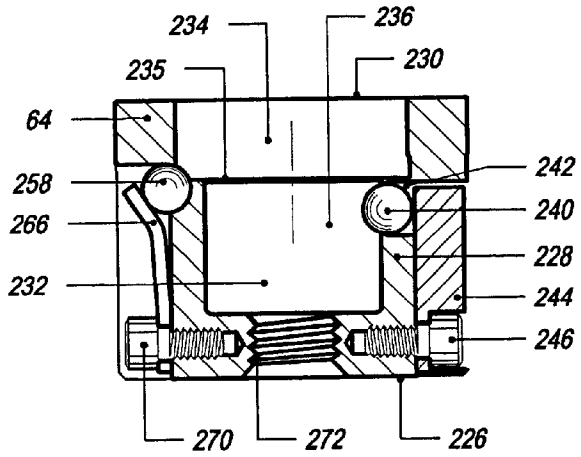

234
236
235
230
64
242
258
240
266
228
232
244
246
270
272
226

FIG. 8

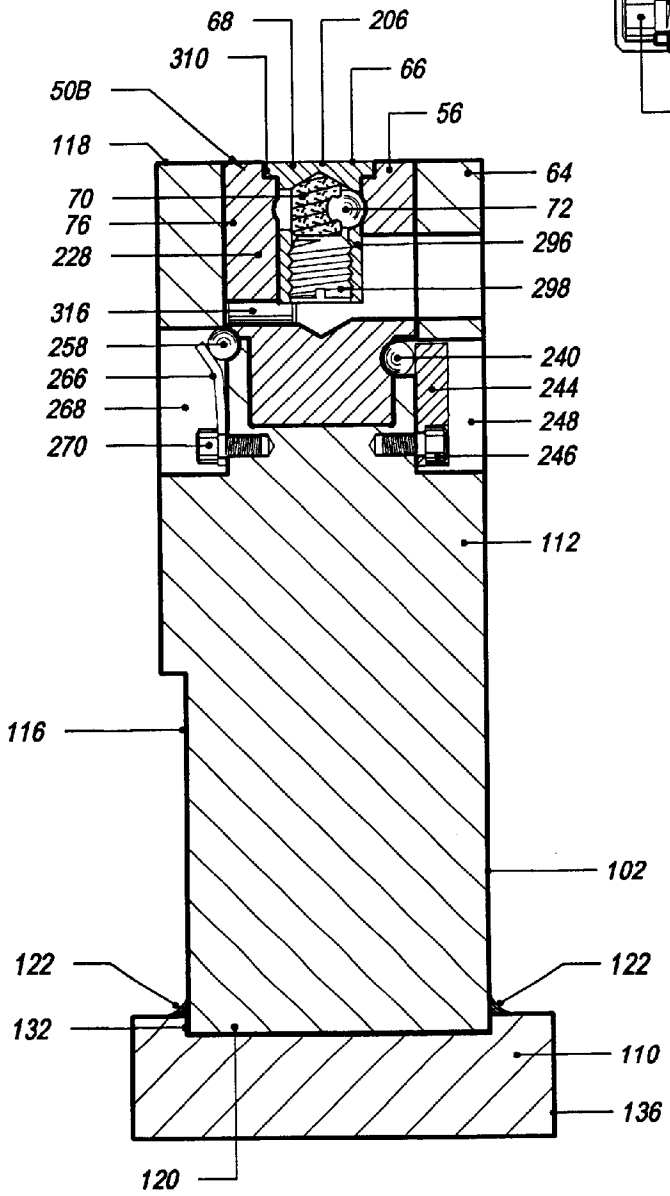

68
206
310
66
50B
56
118
64
70
72
76
296
228
298
316
258
240
266
244
268
248
270
246
112
116
102
122
122
132
110
136
120

FIG. 7

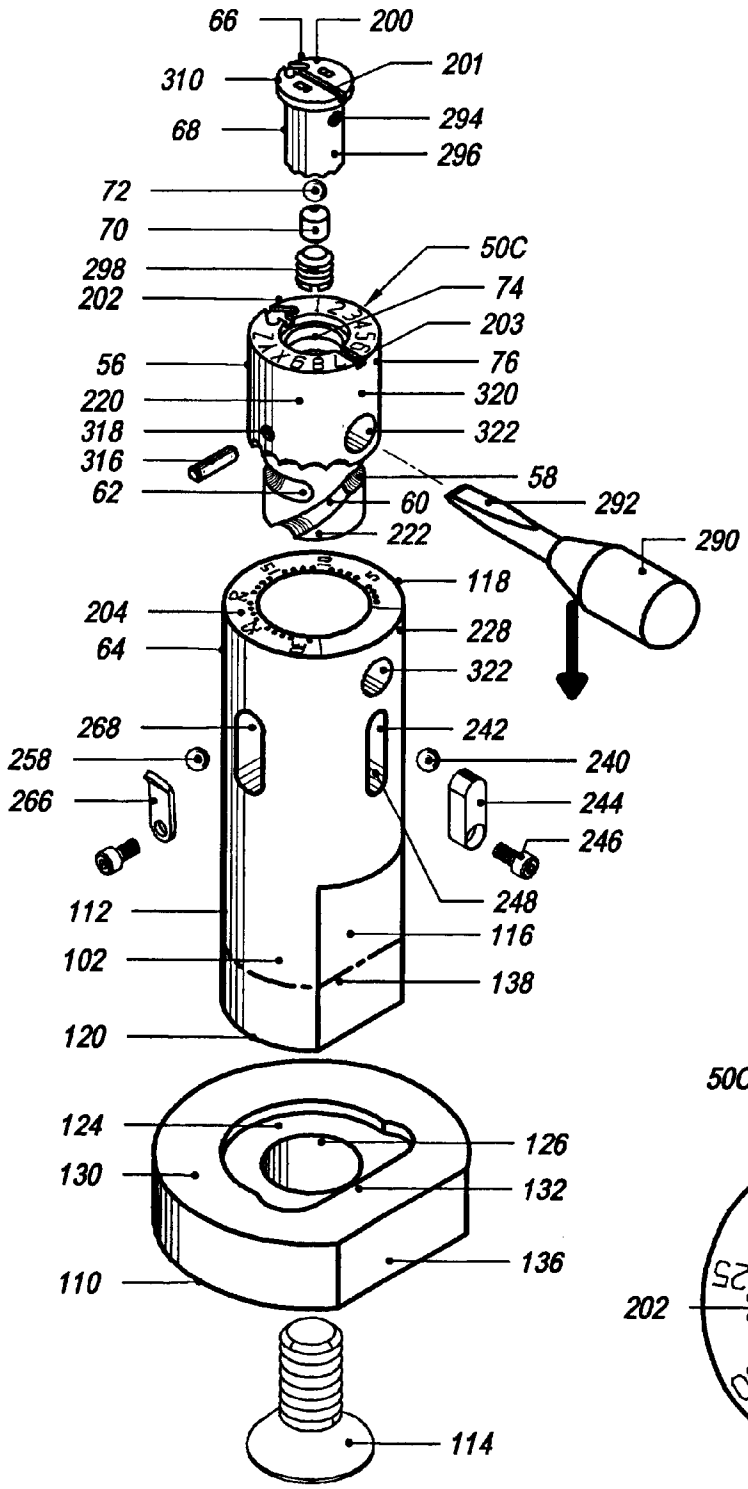

66
200
310
201
68
294
296
72
70
298
50C
202
74
203
56
76
220
320
318
322
316
58
62
60
292
222
290
204
118
64
228
322
268
242
258
240
266
244
246
248
112
116
102
138
120
124
126
130
132
136
110
114

FIG. 9A

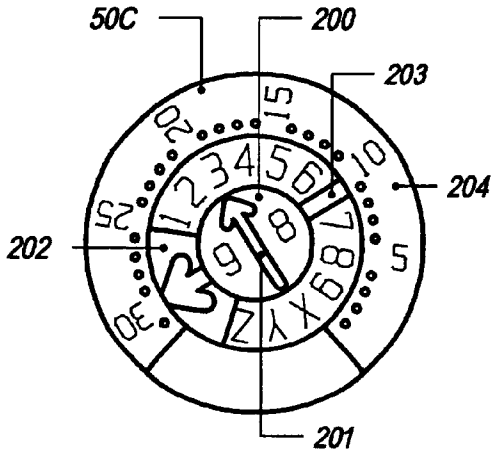

50C
200
203
204
202
201

FIG. 10

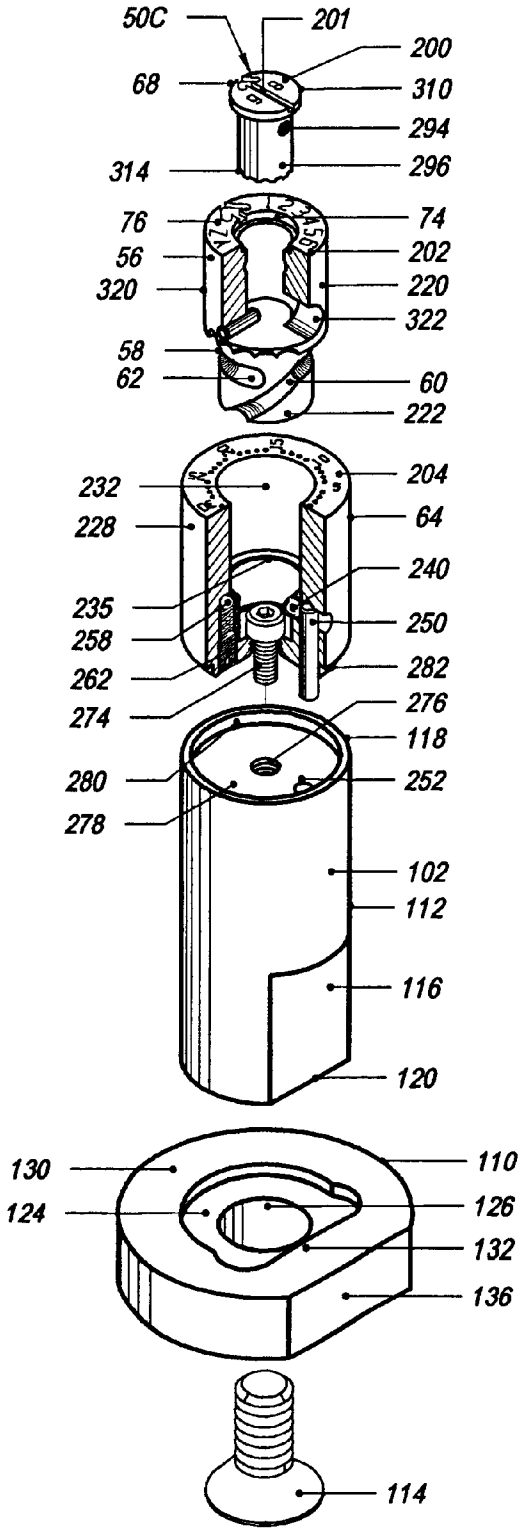

50C
201
200
68
310
294
314
296
76
74
56
202
320
220
322
58
62
60
222
232
204
228
64
240
235
250
258
282
262
276
274
118
280
252
278
102
112
116
120
130
110
124
126
132
136
114

FIG. 9B

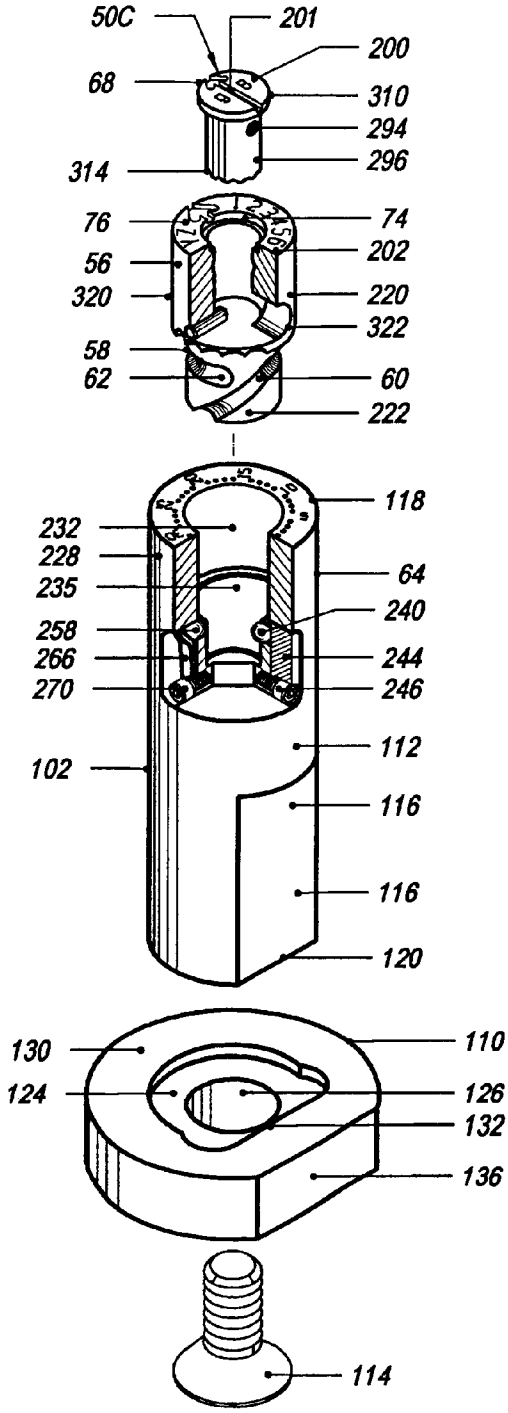

50C
201
200
68
310
294
314
296
76
74
56
202
320
220
322
58
62
60
222
118
232
228
64
235
240
258
244
266
246
270
102
112
116
116
120
130
110
124
126
132
136
114

FIG. 9C

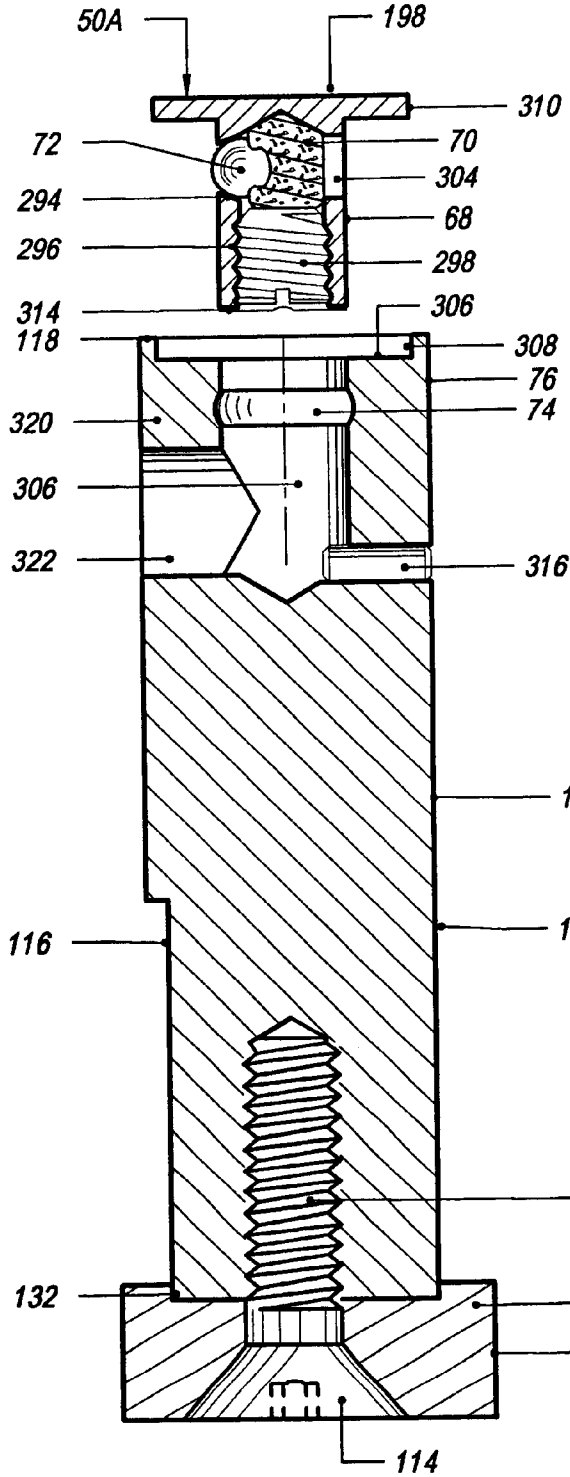

50A
198
310
72
70
304
294
68
296
298
314
306
118
308
76
74
320
306
322
316
112
116
102
128
132
110
136
114

FIG. 11

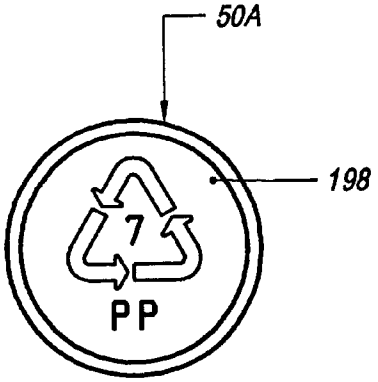

50A
198
7
PP

FIG. 12

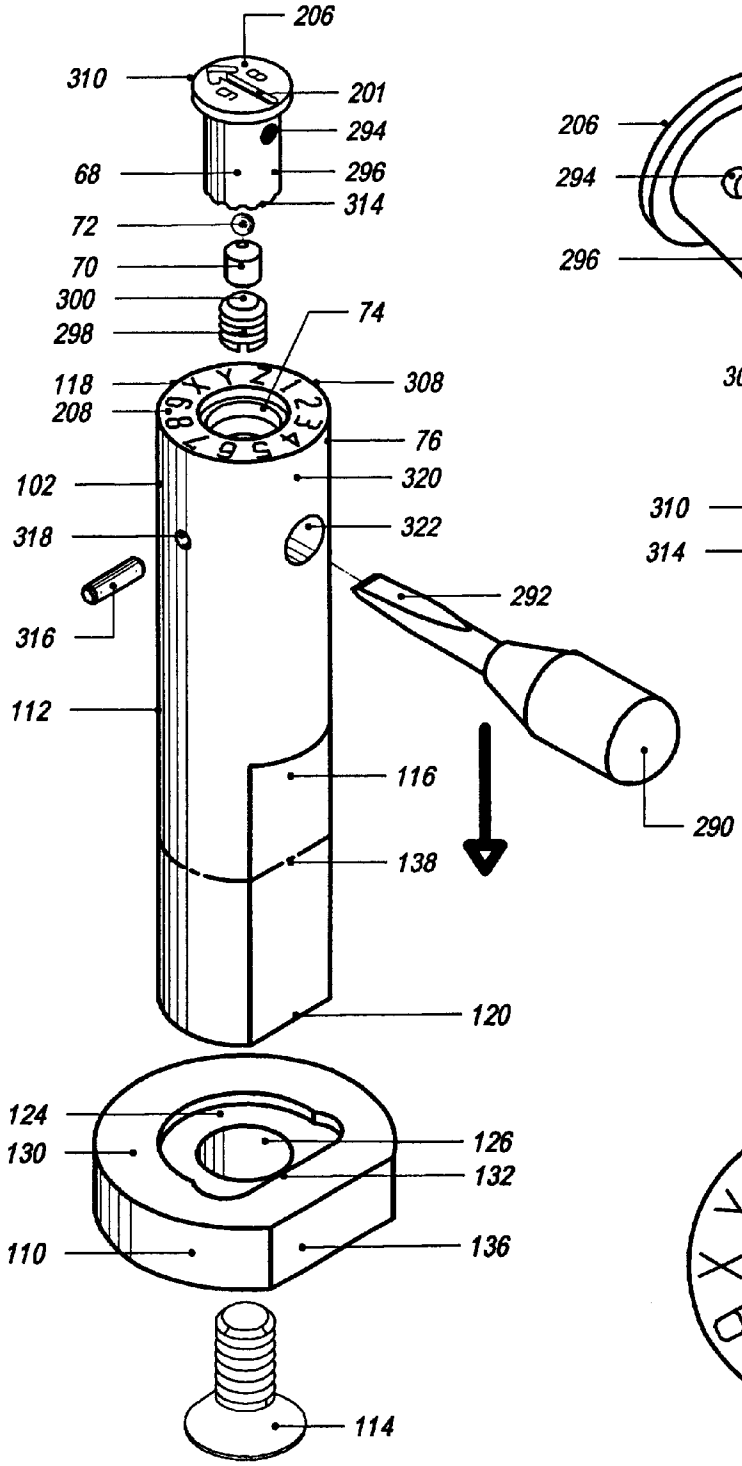


FIG. 13

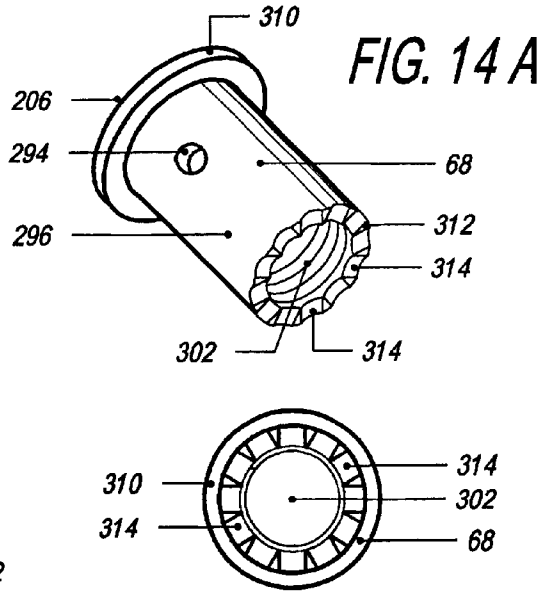


FIG. 14A

FIG. 14B

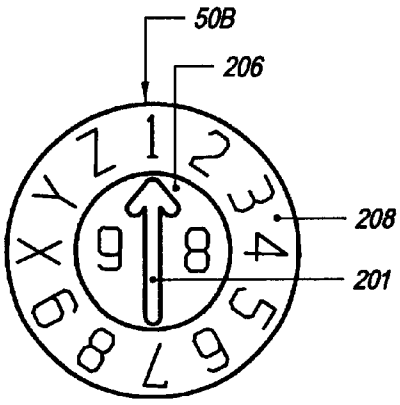


FIG. 14C

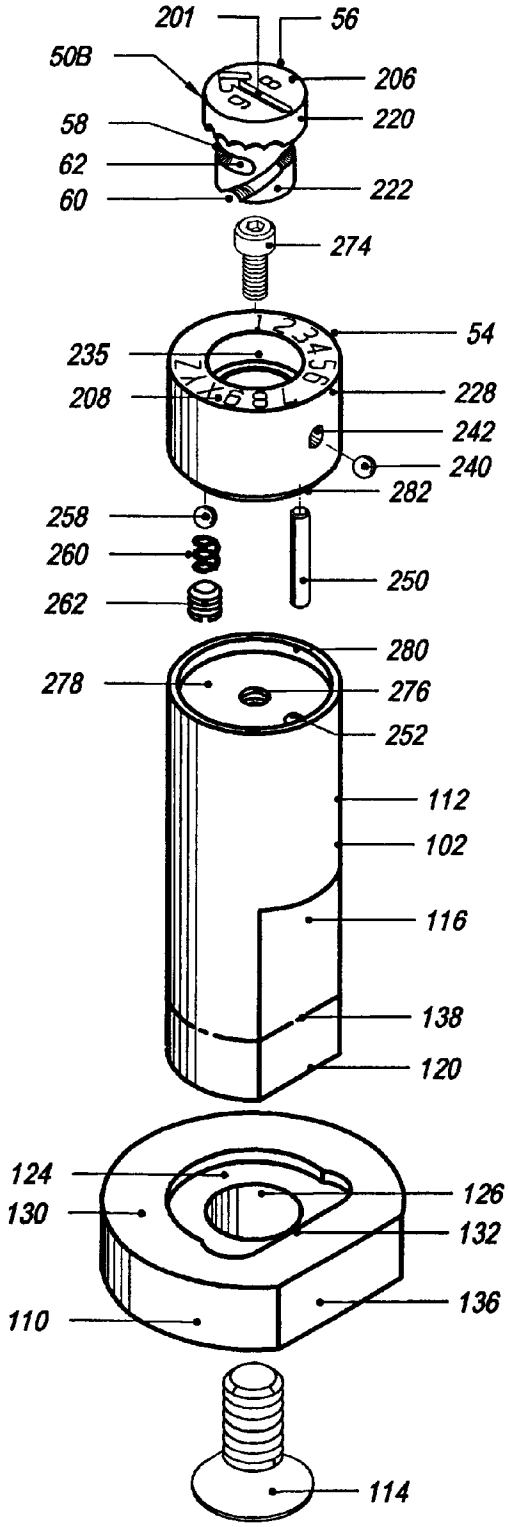

201
56
50B
206
58
220
62
222
60
274
54
235
208
228
242
240
282
258
260
262
250
280
278
276
252
112
102
116
138
120
124
126
130
132
136
110
114

FIG. 15

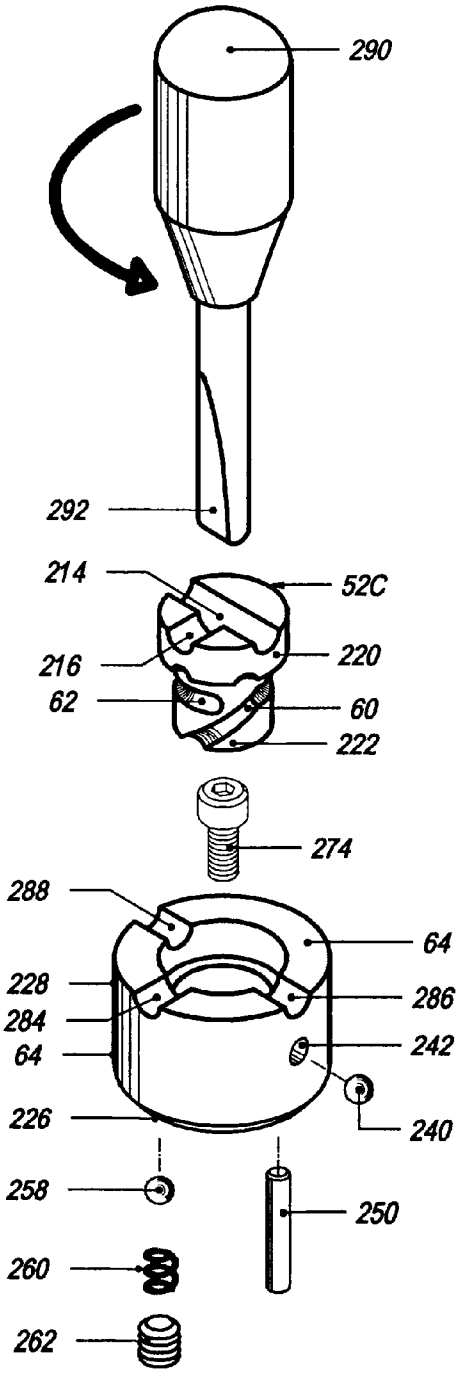

290
292
214
52C
216
220
62
60
222
274
288
64
228
286
284
242
64
240
226
258
250
260
262

FIG. 16

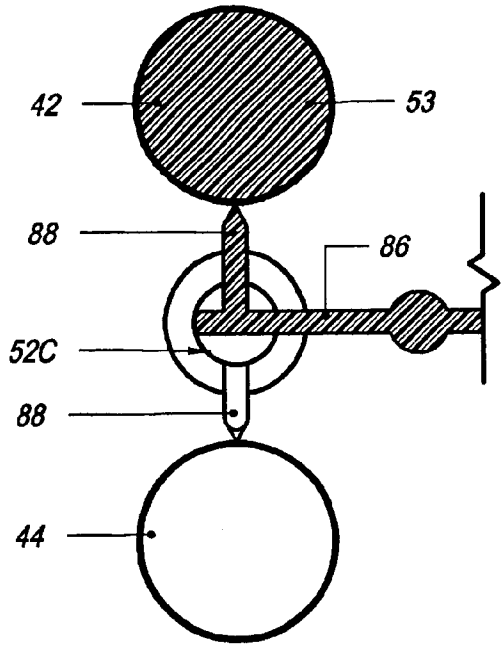


FIG. 17

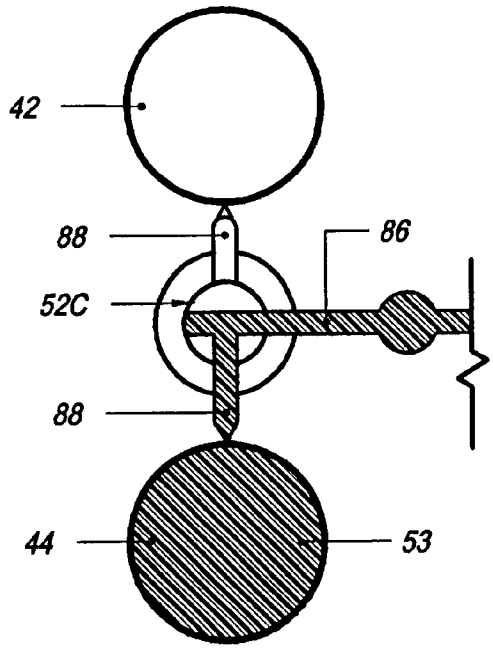


FIG. 18

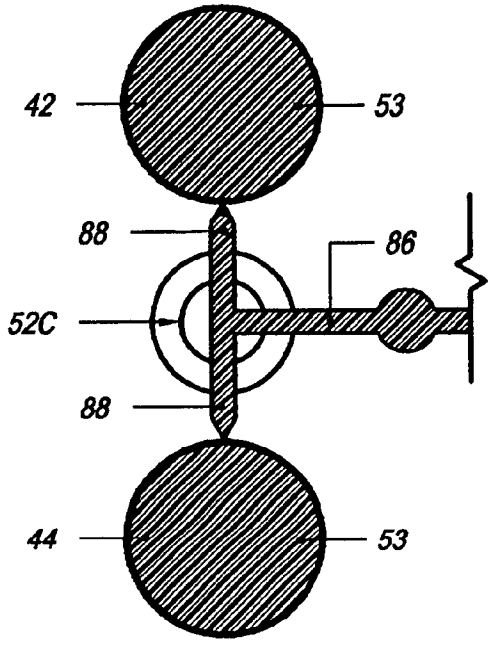


FIG. 19

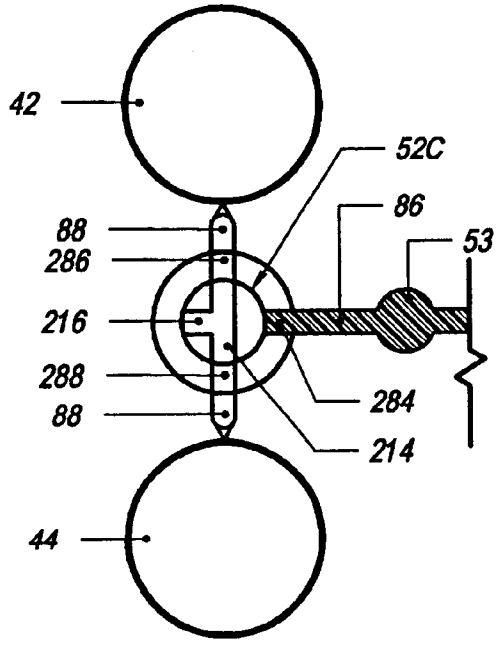


FIG. 20

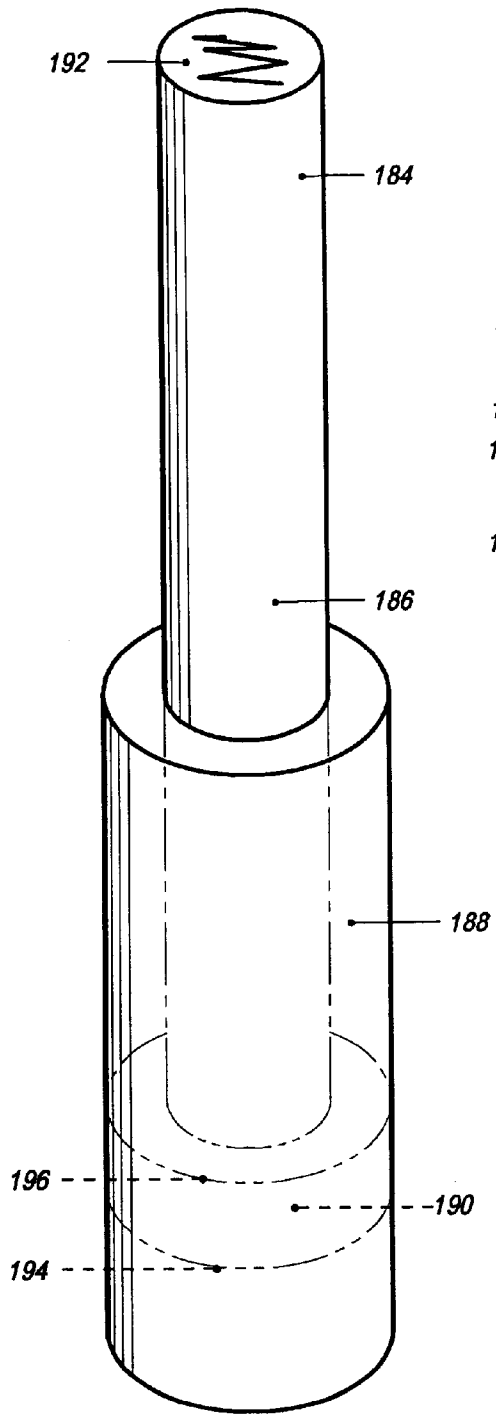


FIG. 23

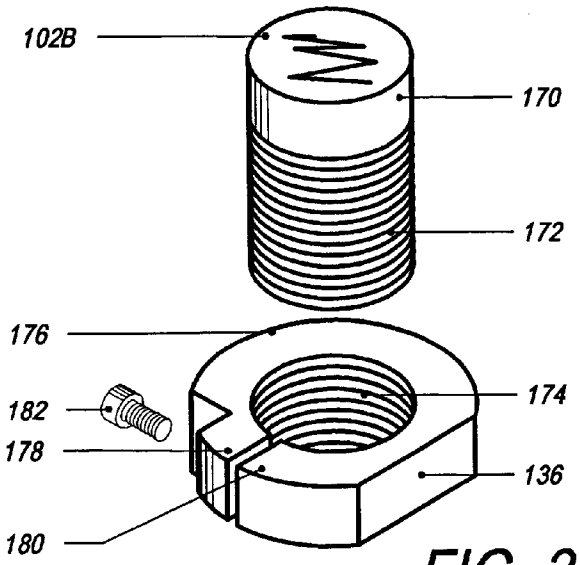


FIG. 22

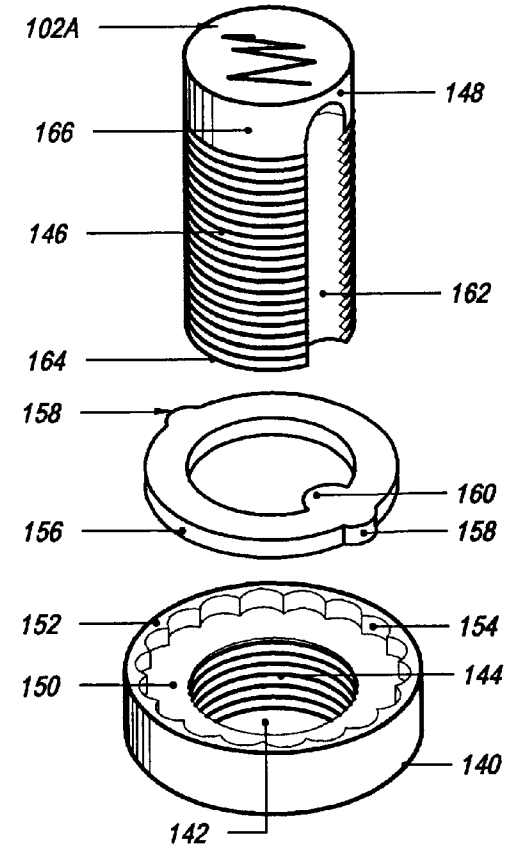


FIG. 21

MOLD INSERT

FIELD OF THE INVENTION

The present invention relates to an insert for a mold for affecting a hardenable material in a mold and more particularly to a rotatable insert capable of controlling flow of the hardenable material or imprinting an indicia into the hardenable material.

BACKGROUND OF THE INVENTION

It is common for molds of all kinds to be equipped with multiple mold cavities to increase production. However, not all of the cavities are needed at all times. Thus, a mechanism is needed which can selectively direct flow to one or more cavities or none of the cavities, if desired.

One such mechanism is disclosed in U.S. Pat. No. 5,208,053 and consists of three pieces, a retainer, a core pin and an outer casing. Unfortunately, no provision is disclosed for removing the core pin without knocking out the entire mechanism by inserting a pin or screwdriver through a bore in the backside of the mold against the retainer. Such a process is time consuming which, in turn, increases mold down time, which is very costly. Moreover, only four core pin positions are disclosed, limiting the number of flow options available. Finally, the mechanism is of no use in throttling flow to a particular cavity. When the core pin is disposed in one position, a pin disposed between the retainer and core pin prevents rotation of the core pin. To rotate the core pin to redirect flow, the pin must be pushed into the retainer which is time consuming and difficult. Such an insert is also ill-suited for imprinting an indicia, such as the date, time and material type into the hardenable material.

What is needed, therefore, is a rotatable mold insert that can be quickly and easily removed or inserted. What is further needed is an insert that can be quickly, easily, and precisely indexed. What is also needed is an insert that can accommodate any kind of insert including, for example, flow-directing inserts and indicia-imprinting inserts. What is still further needed is an insert that is versatile and capable of different functions. What is still further needed is an insert that can be carried by or mounted to one end of an ejector pin.

OBJECTS AND SUMMARY OF THE INVENTION

An insert for a mold for diverting flow of a hardenable material or imprinting an indicia into the hardenable material wherein the insert comprises a plug that is rotatable and which can be quickly and easily removed, when needed, and replaced, if desired. In operation, while the mold halves are separated, the plug can be rotated using a tool, such as a screwdriver, to the desired setting. During mold operation, the plug has an insert face that can have, for example, one or more flow directing channels or an indicia that is imprinted into the hardenable material.

The plug has an outer axial face that is in contact with the hardenable material. The plug has a body that preferably is generally cylindrical, includes a larger head carrying the insert face, and which is received in a receiver that preferably comprises pocket formed by a sidewall. The pocket preferably is formed in one of the mold halves, an ejector pin, another mold component, or a removable cup. A rotating mechanism operably cooperates with the plug and the receiver such that the plug is rotatable and preferably indexable.

In one preferred embodiment, one of the plug and the receiver has a groove that receives a guide that extends from the other of the plug and the receiver so as to facilitate rotation of the plug while opposing withdrawal of the plug. The guide is a protrusion that preferably comprises a pin or a ball.

The guide is a locator that is urged toward the groove. For example, the guide can be urged radially toward the groove by a pin, a finger, or a spring. The finger preferably comprises a leaf spring or beam spring anchored by a fastener. The finger preferably is a coil spring retained by a screw or bolt. The spring can comprise a spring plunger or the like.

In one preferred embodiment, the groove extends about the circumference of the plug and is contoured so as to accept the guide. The groove has a transverse portion and an entranceway that is inclined relative to the transverse portion. The entranceway is constructed and arranged to accept the guide to facilitate fast and easy insertion of the plug into the receiver and removal of the plug from the receiver.

In its preferred embodiment, the groove is comprised of a single transverse portion and a single entranceway. The transverse portion extends no more than about one revolution about the plug and the entranceway extends less than one revolution about the plug. Preferably, the entranceway is inclined at an acute angle relative to the transverse groove portion. In one preferred groove embodiment, the groove is at least about 0.040 inches wide, preferably at least 0.070 inches wide, and at least about 0.020 inches deep, its transverse portion extends between about 250° and about 330° around the plug body, and its entranceway is inclined at an angle of between about 20° and about 40°. Preferably, the entranceway extends between about 40° and about 60° around the plug body. Preferably, the entranceway and transverse portion extend at least about two-thirds of a revolution about the body and no more than about 300° about the body.

So that the plug can be rotated to one of a number of predetermined positions, the head of the plug has a shoulder, formed where the plug diametrically necks down to the body, that cooperates with a detent assembly. The detent assembly preferably comprises a plurality of circumferentially spaced apart notches in an axial surface of the shoulder that cooperate with one or more detents in the pocket. The detent preferably is a pin or a ball that can be resiliently biased toward the shoulder to facilitate ease of rotation and indexing.

To rotate or remove the plug from the pocket, a tool, such as a blade of a screwdriver, engages the face of the plug head to rotate the plug. To remove the plug, the plug is rotated in one direction until the guide reaches the entranceway. Further rotation in the one direction causes the guide to ride further along the entranceway until it reaches the mouth or opening of the entranceway thereby freeing the plug completely from the pocket. As the guide rides along the entranceway, the angle of the entranceway displaces the plug such that its face is no longer flush with the mold, cup or ejector pin carrying the plug so that it can be manually removed.

In inserting the plug, the plug is dropped into the pocket and rotated in the opposite direction until the guide enters the mouth of the entranceway. Further rotation causes the guide to ride along the entranceway until the plug completely retracts into the pocket such that the face is flush with the mold, the ejector pin, or the cup carrying the plug. Further rotation causes the guide to traverse from the entranceway to the transverse portion.

In another preferred embodiment, the plug has a protrusion that registers with a groove in the inner sidewall that forms the pocket. Preferably, the protrusion is a ball that is biased outwardly from the plug body by a wad received within a hollow in the body. The wad preferably is comprised of an elastomeric material or another resilient synthetic or natural material. A cap or core at one end of the plug body engages the body to retain the wad within the plug. In its preferred embodiment, the cap is a screw or bolt.

The head of the plug is received in a complimentary recess in the pocket. Preferably, the recess is configured so as to receive the head such that the outer axial face of the head is substantially flush with the surrounding mold or cup.

So that the plug can be selectively indexed, a detent mechanism or assembly cooperates with the plug. The detent mechanism comprises a detent carried by the mold, the pin or the cup that cooperates with at least one of a plurality of detent notches in the axial end of the plug body. In its preferred form, the detent comprises a pin or ball that extends generally radially inwardly into the pocket.

To facilitate removal of the plug, there is an access port in the sidewall. A tool is inserted through the port where it is used to pry the plug upwardly relative to the pocket so it can be grasped and removed.

Where a cup is used, the cup has an endwall and an endless sidewall that preferably is cylindrical to form a cylindrical pocket. The cup can be received in its own pocket in the mold that can comprise a bore or an indention in the mold. Where disposed in its own pocket, a fastener secures the cup to the mold. The endwall has a bore through which the fastener is inserted such that it is received in a threaded bore in the mold. The bore in the endwall is threaded and larger than the bore in the mold so the fastener can be removed and a jackscrew inserted to remove the cup from its pocket when it is desired to remove the cup.

An insert of this invention can be mounted to or carried by an ejector pin. The ejector pin includes a removable head and a barrel that can be cut to the desired length for the mold into which it is to be assembled. In one preferred mounting arrangement, the head has a recess with a locator, preferably a flat, that receives a complementary end of the barrel. The end of the head has a bore that receives a fastener that threads into the barrel to mount the head to the barrel. The head has a locator, preferably a flat, that registers with a complementary locator of an ejector plate assembly of the mold to keep the ejector pin from rotating during mold operation. By preventing pin rotation, circumferential or angular location of the outer axial face of the insert is maintained during mold operation.

In another ejector pin embodiment, the end of the barrel is threaded and threadably received in a threaded bore in the head. In one preferred head arrangement, the head can be generally U-shaped having a pair of arms separated by a gap that is closed to clamp the arms around the barrel when a fastener engages both arms. When assembled, the head preferably is incapable of rotating relative to the barrel.

In another preferred head arrangement, the head has an axially extending locator groove in the threaded end that receives a radially inwardly extending locator of a locator ring or washer that is received in a recess in the head. The ring has at least one and preferably a plurality of circumferentially spaced apart locators that are received in locator notches of the recess. When assembled, the ring prevents the barrel from rotating relative to the head.

In still another preferred ejector pin embodiment, the pin is partially formed and completed at a remote location that can be, for example, where the mold is located, a mold manufacturing plant, a distributor, or an end user. The pin is partially finished from a blank that preferably is bar stock or round stock partially machined to form at least a portion of the barrel. The outer surface of the barrel is hardened by a hardening process such as shot peening, nitriding, or another suitable hardening process.

In finishing the pin, preferably after shipment to the remote location, the length of the pin is selected and the unmachined portion is machined to form the head. Typically, a portion of the unmachined portion is cut to cut the pin to the desired length before the head and remainder of the barrel are machined.

If desired, a locator, such as a locator flat or the like, can be machined into the head to keep the head and barrel from rotating during operation. If desired, an insert can be mounted to the end of the barrel opposite the ejector pin head.

Objects, features, and advantages of the present invention include a mold insert that is easy to install in a mold; is easily removed; is quick and easy to rotate; is quick and easy to change; minimizes mold downtime; can be installed on an ejector pin; and is an insert that is rugged, simple, flexible, reliable, and durable, and which is of economical manufacture and is easy to assemble, install, and use.

Objects, features, and advantages of the present invention include an ejector pin that is easy to install in a mold; maintains location of an insert mounted thereto; is efficient to manufacture because it is cut to length after initial manufacture; and is an ejector pin that is rugged, simple, flexible, reliable, and durable, and which is of economical manufacture and is easy to assemble, install, and use.

Other objects, features, and advantages of the present invention will become apparent to those skilled in the art from the detailed description and the accompanying drawings. It should be understood, however, that the detailed description and accompanying drawings, while indicating preferred embodiments of the present invention, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

At least one preferred exemplary embodiment of the invention is illustrated in the accompanying drawings in which like reference numerals represent like parts throughout and in which:

FIG. **1** illustrates a top view of a mold having a plurality of displaceable inserts of this invention carried by the mold;

FIG. **2** illustrates a cross sectional view of the mold taken along line **2**—**2** of FIG. **1** depicting a pair of the inserts each carried by an axially displaceable pin;

FIG. **3** illustrates a cross sectional view of the mold taken along line **3**—**3** of FIG. **1** depicting another pair of the inserts each carried by a body of the mold;

FIG. **4** illustrates a partial fragmentary cross sectional view of the mold with a plug of a first preferred embodiment of an insert exploded for clarity;

FIG. **5** is an enlarged view of the insert shown in FIG. **4**;

FIG. **6** is an enlarged view of a portion of the insert enclosed by the circle shown in FIG. **5** depicting a helical groove that facilitates rotation of the plug of the insert;

FIG. **7** illustrates a second preferred embodiment of an insert carried by one of the pins;

FIG. **8** illustrates a sleeve of the insert for receiving the insert plug;

FIG. **9**A illustrates a third preferred embodiment of the insert;

FIG. **9**B illustrates a fourth preferred embodiment of the insert;

FIG. **9**C illustrates a fifth preferred embodiment of the insert;

FIG. **10** illustrates a top surface of the insert plug shown in FIGS. **9**A–**9**C for imparting an indicia to the hardenable material in contact with the top surface;

FIG. **11** illustrates an enlarged exploded cross sectional view of the second preferred embodiment of the insert;

FIG. **12** illustrates a top surface of the insert plug shown in FIG. **11**;

FIG. **13** shows a still further plug arrangement;

FIG. **14**A illustrates a perspective end view of the plug shown in FIG. **13**;

FIG. **14**B illustrates a bottom view of the plug;

FIG. **14**C illustrates a top view of the top surface of the insert;

FIG. **15** illustrates an exploded perspective view of another preferred embodiment of the insert and ejector pin showing one preferred embodiment for mounting the pin to a head;

FIG. **16** is an exploded perspective of an insert for diverting flow;

FIGS. **17**–**20** illustrates control of flow using the insert shown in FIG. **16**;

FIG. **21** is a perspective view of another preferred ejector pin embodiment illustrating a novel mounting arrangement for mounting the barrel to a head to form the pin;

FIG. **22** is a perspective view of a still further preferred embodiment of an ejector pin illustrating a still further mounting arrangement; and

FIG. **23** is a perspective view of still another preferred ejector pin embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

I. Introduction

FIGS. **1**–**4** depict a mold **40** having a plurality of cavities **42**, **44**, **46**, and **48**, and a plurality of inserts **50***a*–**50***c* and **52***a*–**52***c* of this invention for controlling the flow of material **53** (FIG. **3**) being communicated to one or more of the cavities **42**, **44**, **46** and **48** and for imparting an indicia to material **53** in one or more of the cavities **42** and **44** as the material **53** in the cavities **42** and **44** hardens. Each insert **50** and **52** includes a rotating mechanism to enable it to rotate relative to the mold **40**. Each insert **50** and **52** preferably is indexable to certain positions to control or divert flow or to select a particular indicia to imprint into the hardenable material **53** in the mold cavity.

Referring to FIG. **5**, one preferred rotating mechanism **54** has a plug **56** with a circular groove **58** that is received in a receiver that, in this instance, comprises a cup **64**. The groove **58** has a helical portion **60** that enables the insert to be easily removed when rotated beyond a certain point. The groove **58** also has an axial or transverse portion **62** that enables the insert **50** or **52** to be rotated relative to the cup **64**.

Another preferred rotating mechanism **66** has a plug **68** that utilizes a biasing element **70** that outwardly urges a locator **72** that rides in an internal groove **74** in a cup **76** that helps retain the plug **68** in the cup **76** while allowing it to rotate relative to the cup **76**.

Preferably, each rotating mechanism **54** and **66** can be constructed with at least a plurality of circumferentially spaced apart detents so the plug and insert carried by the plug can be selectively indexed to certain settings when rotated.

II. Mold Construction

One portion of an exemplary mold **40** is shown in FIG. **1**. The mold portion preferably is a mold half **84** having an exterior mold cavity surface **78** with at least one recess or cavity **42**, **44**, **46** or **48** for receiving a material **53** that preferably is a liquid but which is hardenable. The mold **40** has another portion, preferably another mold half, that also has an exterior mold cavity surface that can have one or more recesses that are mold cavities. One or both mold halves preferably has a plurality of locator bores **80** each for receiving a guide pin **82** that accurately locates one mold half **84** relative to the other mold half such that when the mold halves are brought together they accurately mate or register with one another.

In the exemplary mold half **84** shown in FIG. **1**, one of the cavities **44** has a single insert **50***b* for imprinting on material **53** within the cavity **44** as it hardens the day and year of molding. Another of the cavities **42** has a pair of the indicia-imprinting inserts **50***a* and **50***c* each for leaving an imprint or imprinting an indicia on the exterior of an object being molded in the cavity **42**.

So that the material **53** can reach each mold cavity **42**, **44**, **46**, and **48**, there is a runner **86**, that serves as a supply channel, that is connected to individual feeder channels, referred to as subrunners **88**, each of which leads to a cavity. One or both mold halves has an sprue puller **90** that leads from a source of the flowable material **53** preferably to the supply channel **86**.

As is shown in FIG. **1**, one or more of the channels **86** and **88** can have an insert **52**, referred to as a flow diverter, that is constructed and arranged to control flow through the channel. One of the flow controlling inserts **52***c* is located in the supply channel **86** where it branches to a pair of the feeder channels **88**. The flow control insert **52***c* can be rotated to completely block flow through both feeder channels **88**, block flow through any one of the feeder channels **88**, permit flow through either feeder channel **88**, or permit flow through both feeder channels **88**.

Another of the flow controlling inserts **52***a*, referred to as a runner flow shutoff, is disposed in one of the feeder channels **88** for blocking or allowing flow through the channel **88**. If desired, the runner flow shutoff insert **52***a* can be disposed in one of the supply channels **86**.

Referring to FIGS. **2** and **4**, the mold **40** has a body **92** carrying the top mold cavity surface **78**, a lower clamp plate base **94** and a pair of risers **96** (sidewalls) supported on the base **94** which in turn supports the mold body **92**. The mold body **92**, sidewalls **96** and base **94** define therein an ejector chamber **98** in which is located an ejector plate assembly **100**. The ejector plate assembly **100** is coupled to at least one ejector pin **102** of this invention.

Referring to FIG. **2**, the ejector plate assembly **100** has an upper ejector plate **104** and a lower backing plate **106** that are fastened together capture one end of each of the ejector pins **102** such that each ejector pin **102** moves substantially in unison with the plates **104** and **106**. The opposite end of each ejector pin **102** is slidably telescopically received in a

bore in the mold body **92**. FIG. **3** shows a conventional ejector pin **103** of one-piece, unitary construction. A pair of spaced apart stops **108** are shown in FIG. **2** carried by the base **94** within the chamber **98** for preventing the backing plate **106** from bottoming out directly against the base **94**.

The plates **104** and **106** are preferably connected to prime mover that can be a lift or a cylinder, such as a hydraulic cylinder or gas cylinder (not shown). During operation, the plates **104** and **106** and pins **102** are raised after the material **53** in the mold cavity associated with the pin or pins has suitably hardened. When the pins are raised, the free end of each pins bears against the hardened material **53** in the mold to eject it from the mold so it can be removed.

The mold **40** shown in the drawing figures is an exemplary mold. The novel inserts **50** and **52**, rotating mechanisms **54** and **66**, and injector pins **102** disclosed herein are capable of being used with other mold configurations, with other types of molds, and in other types of molding environments.

Ejector Pin

As is shown in FIG. **2**, one of the inserts is mounted to the end **118** of each ejector pin **102**. Of course, the ejector pin **102** of this invention can be used with no insert.

Each pin **102** is constructed of a strong and resilient material, that can be a metal, a composite, a polymeric material, a thermoset material, or another suitable material. Preferably, each pin **102** is constructed of steel that preferably is a stainless steel, such as surface hardened H13 steel, or the like.

As is shown in FIG. **2**, each pin **102** of this invention has a head **110** at one end that is mounted to an elongate barrel **112**. The head **110** is preferably mounted to the barrel **112** by a fastener **114**, such as a screw or a bolt, that is extends through a bore **126** (FIG. **9A**) in the head and which is threadably received in a threaded bore **128** in the end **120** of the barrel **112**.

For example, the fastener **114** can be a cap screw, set screw, a machine screw, or the like. If desired, the head **110** can be mounted using another type of fastener or fastening method. For example, a fastener that is an adhesive, such as a glue, solder, or another adhesive material can be used to mount the head **110** to the barrel **112**. If desired, the head **110** can be fastened to the barrel **112** by another fastener that is a weld **122** (FIG. **7**). Such a weld **122** can be created using any suitable welding process including arc welding, friction welding, inertia welding, friction welding, laser welding, electron beam welding, or the like. If desired, the head **110** can be fastened to the barrel **112** by a friction fit, an interference fit, or the like.

Referring to FIG. **9A**, the barrel **112** of the pin **102** preferably has a locator flat **116** at its end **120** opposite its free end **118**. The head **110** has a recessed land **124** that, in turn, defines an upraised sidewall **130** that is substantially complementary to the cross sectional shape of the barrel end **120**. In the preferred embodiment shown in drawing FIGS. **4**, **11**, and **15**, for example, the bore **126** in the head **110** extends completely through the head **110**. To threadably receive the fastener **114**, the bore **128** in the end **120** of the barrel **112** preferably is internally threaded but can be unthreaded, or have radially inwardly extending axial or radial ridges, or the like.

The sidewall **130** around the recessed land **124** has a locator **132** against which the locator **116** of the barrel **112** bears when the barrel **112** is inserted into the recessed land **124**. Preferably, the locator **132** is a flat in an inner radial portion of the sidewall **130**.

When the barrel **112** is mated to the head **110**, the locator **116** if the barrel **112** registers with the locator **132** of the head **110**. The locators **116** and **132** and recessed land **130** help radially center the barrel **112** on the head **110**. The locators **116** and **132** also help circumferentially locate the barrel **112** relative to the head **110** so the axially outermost surface of an insert mounted to the barrel **112** is desirably located or oriented relative to the mold cavity within which it is received. The locators **116** and **132** still further prevent relative rotation between the head **110** and barrel **112** so that the insert maintains its desired angular location or orientation during mold operation.

When assembly is completed, the head **110** and barrel **112** form an ejector pin **102** of this invention that behaves as a pin **103** (FIG. **3**) of one-piece, integral and unitary construction. When assembly is completed, the head **110** and barrel **112** form a pin **102** of this invention that advantageously functions as a pin **103** of one-piece construction.

As is shown in FIGS. **2** and **4**, the head **110** of each pin **102** is captured between the upper ejector plate **104** and the lower ejector plate or lower backup plate **106**. The upper ejector plate **104** has a recess complementary to the shape of the head **110** for receiving and locating the head **110**. The upper plate **104** also has a bore through which the barrel **112** of the pin **102** projects. The upper plate **104** also includes a locator **134** that registers with an outer locator **136** of the pin head **110**. Preferably, the outer locator **136** is a flat portion in the exterior of the sidewall **130**. Preferably, the locator **134** in the ejector plate **104** is a flat portion that is complementary to locator **136**.

When assembled between the ejector plates **104** and **106**, the pin **102** moves in unison with the plates **104** and **106**. As a result of the locators **134** and **136** registering with each other, the pin **102** will not rotate relative to the plates **104** and **106** or the mold **40** during operation. By this advantageous construction, the pin **102**, and any insert **50** carried by the pin **102**, also cannot rotate thereby maintaining the angular location of any insert **50** carried by the pin **102**.

Referring to FIG. **9A**, the barrel **112** of the pin **102** can be cut, such as along phantom line **138**, to accommodate the mold **40** into which it is to be assembled. This enables the barrel **112** of the pin **102** to be of a standard length that is cut to the desired length for the type or size of mold into which it is to be installed. Of course, as is depicted in FIG. **9A**, the desired length of the pin **102**, denoted by phantom line **138**, typically is shorter than the standard barrel length.

In this manner, the ejector pin **102** of this invention can be assembled of standard length and size components and cut to the length required by the specific mold into which it is to be assembled before its assembly into the mold. This can be done prior to shipment or after shipment of the pin **102**, by an end user. An example of such an end user can be a mold maker, or a user or operator of the mold.

This also enables a pin **102** with an insert **50** to be manufactured as an assembly, such as is shown in FIGS. **2**, **3** and **7**, prior to its installation into a mold **40**. Even with an insert **50**, the barrel **112** can be cut to size by either a mold-maker or an operator or user of the mold. So that the pin **102** can be used with molds of many different types and sizes, the locator surface **116** preferably is at least about two inches long. For pins **102** having a diameter of at least about one-quarter inches, the locator surface **116** is even longer and preferably is at least about four inches long.

The barrel **112** can be cut in any manner. For example, an abrasive cutting method can be used, such as a saw, a wire EDM, a lathe, or another cutting process. If desired, a laser,

oxyacetylene, or the like can be used. If desired, another nonabrasive cutting or material removal method can be used. Preferably, the barrel **112** is cut such that the cut end is generally flat so that the axis of the barrel **112** is generally perpendicular to the lengthwise direction of the head **110** when assembled thereto. Preferably, the barrel **112** is cut such that its end is substantially square with the head **110**.

In one preferred method, the desired length of the pin **102** is determined and the barrel **112** is marked with a cut line **138** such that the pin **102** will have the desired length when the head **110** is assembled. Thereafter, using the marked cut line **138**, the barrel **112** is cut. After cutting is completed, the head **110** is assembled to the barrel **112** forming the pin **102**. After the pin **102** is assembled, the pin **102** is installed in the mold **40** such that the pin **102** is captured by an ejector plate assembly. Preferably, the pin **102** is assembled such that its head **110** is captured by ejector plate assembly **100**.

Another preferred ejector pin embodiment **102***a* (FIG. **21**), including its head **140**, barrel **148**, and novel mounting arrangement, is shown in FIG. **21**. The head **140** has a bore **142** with internal threads **144** for receiving and threadably engaging a threaded portion **146** of the barrel **148** that is located at the end of the barrel **148**. Only a portion of the barrel **148** is shown in FIG. **21**. The head **140** has an axially inwardly extending recess or counterbore **150** that is defined by an upraised sidewall **152** and faces toward the barrel **148** when the barrel **148** is assembled to the head **140**. The radially inner surface of the sidewall **152** has a plurality of pairs of generally arcuate notches **154** forming an arcuately notched radial inner periphery.

A coupling ring **156** is used to help couple the barrel **148** to the head **140** such that there is no relative rotation between the barrel **148** and head **140**. The ring **156** is received in the counterbore **150** in the head **140**. The ring **156** has a pair of radially outwardly extending, circumferentially spaced apart, and preferably arcuate projections **158** that are each received in one of the notches **154** thereby preventing the ring **156** from rotating relative to the head **140**. An arcuate locator projection **160** that extends radially inwardly from the ring **156** is received in a radially inwardly extending locator groove **162** that extends axially at least a portion of the length of the barrel **148**. As is shown in FIG. **21**, the groove **162** extends axially from the threaded end **164** of the barrel **148** toward the opposite end. So that the barrel **148** is of sufficient length so it can be cut to a wide variety of lengths, the groove **162** is elongate and preferably terminates axially beyond the threaded portion **146** at an unthreaded portion **166** of the barrel **148**. If desired, the ring **156** can be a washer.

In use, after the barrel **148** is cut to length, the ring **156** is placed over the threaded end **146** of the barrel **148**, and the barrel **148** is threaded into the head **140**. When the barrel **149** is threaded sufficiently far into the head **140**, the ring **156** is urged axially toward the head **140** until the ring **156** is received in the recess **150** such that its locators **158** are received into locator notches **154** in the head **140**. When the ring **156** is received in the recess **150**, it functions as a locking mechanism to prevent the barrel **148** from rotating relative to the head **140**. So that both the head **140** and barrel **148** do not rotate relative to the ejector plate assembly **100**, the head **140** can have a locator, such as the locator surface **136** shown in FIG. **15**.

FIG. **22** depicts another preferred ejector pin embodiment **102***b*. The barrel **170** has a threaded portion **172** adjacent one end that is threaded into a threaded bore **174** in the head **176**. The head **176** is generally U-shaped and comprises a pair of arms **178** and **180** clamped around the threaded portion **172** by a fastener **182** that joins the arms **178** and **189** together. Preferably, the fastener **182** extends through a bore in one of the arms **178** into a threaded bore in the other of the arms **180**.

FIG. **23** illustrates a novel ejector pin blank **184** from which an ejector pin **103** (FIG. **3**) of one-piece and unitary construction is constructed. The blank **184** comprises a hardened barrel portion **186** and an unhardened portion **188** that can be cut to the desired length and turned on a lathe to form the ejector pin head **190** (shown in phantom). The ejector pin blank **184** preferably is shipped substantially in the form shown in FIG. **23** to an end user, such as a mold operator or the like, who can complete manufacture of the ejector pin by cutting the unhardened portion **188** to size and thereafter turning it to form the head **190**. If desired, the unhardened portion **188** can be cut to size substantially simultaneously while it is being turned.

For example, for the blank shown in FIG. **23**, a portion of the end of the bar stock can be cut to phantom line **194** or turned to phantom line **194**. The bar stock is also turned to phantom line **196** to form the head **190**. When turning of the head **190** is finished, it results in an ejector pin **103** of one-piece and unitary construction, such as the ejector pin **103** shown in FIG. **3**, having a length suitable for the mold in which it is to be installed.

In a method of making the blank **184**, bar stock comprised of a metal or another machinable material is machined to form a necked down portion **186** having a diameter less than that of the bar stock and the unhardened portion **188**. Preferably, the bar stock is machined by turning it on a lathe, or by using another material removal process, to provide the necked down portion **186**. Thereafter, the necked down portion **186** preferably is hardened, such as by a nitriding or another surface hardening process, such that the exterior of portion **186** is hardened about its circumference from the end **192** of the blank **184** substantially to the unhardened portion **188**. The diametrically necked down portion **186** is hardened to a depth of at least about one micron, and as much as one-hundred microns, about the periphery of the pin barrel to minimize wear of the pin **103** as it is repeatedly reciprocated in the mold **40** during operation.

The bar stock preferably is comprised of a machinable or formable material that is suitable for use as an ejector pin **103**. One preferred bar stock material is H13 steel alloy because it can be easily machined or formed while possessing good wear resistance and toughness. Other metals and alloys can be used.

Insert

1. Indicia Imprinting Insert

FIGS. **1**, **10**, **12** and **14**C shows three different exemplary and preferred indicia-imprinting inserts **50***a*, **50***b*, and **50***c* carried by the mold and each of which are disposed in a mold cavity. Where an indicia-imprinting insert is not referred to by letter a, b, or c, it is generally referred to as reference numeral **50**. An indicia-imprinting insert **50** of this invention is constructed and arranged to leave an imprint of its outer surface **198** when the hardenable material **53** in the cavity has hardened.

Referring to FIGS. **1** and **12**, one such insert **50***a* is mounted to a pin **102** in cavity **42** and is constructed such that it preferably does not rotate. The insert **50***a* preferably is used to imprint the type of hardenable material **53** being molded. For example, the insert **50***a* indicates material no. 7 for polypropylene.

Referring to FIGS. **1** and **10**, another such insert **50***c* is mounted to a pin **102** in the cavity **42** and which has a removable circular centrally located, indicia-imprinting outer insert surface **200** carried by plug **68**. The plug **68** is received within a pair of generally concentric indicia-imprinting rings **202** and **204**. Both the center insert surface **200** and the inner ring **202** preferably can be rotated, both relative to each other and relative to the outer ring **204**.

The insert **50***c* is used to imprint the date, month and year into the hardenable material **53** being molded. The center insert surface **200** imprints the year and an arrow **201** that indicates the month of molding, with the months imprinted by the inner ring **202**. The inner ring **202** also has an arrow **203** that indicates the day of the month, with the days of the month imprinted by the outer ring **204**. The arrows **201** and **203** preferably are recessed so as to accept a blade of a screwdriver to quickly and easily turn the insert surface **200** or ring **202**.

Referring to FIGS. **1**, **9**A, and **14**C, a still further such insert **50***b* is mounted to the pin **102** in another cavity **44** which has a central, circular indicia-imprinting insert surface **206**, which is rotatable, and an outer indicia-imprinting ring **208** that preferably is stationary. The insert **50***b* is used to imprint the month and year into the hardenable material **53** being molded.

Each of the aforementioned inserts **50** imprint a specific indicia. Other inserts **50** are possible that fall within the scope of the invention, including inserts that imprint messages, pictures, trademark symbols, trademarks, trade names, model numbers, part numbers, the time of manufacture, time of expiration, and other messages, symbols, or functions.

Each insert **50** preferably is carried by an ejector pin **102** or **103**. However, where the insert **50** has a portion that is rotatable, it need not be carried by an ejector pin **102** but can reside in the mold cavity, preferably within a pocket in the cavity.

2. Runner Flow Shut-Off Insert

FIGS. **1** and **5** depict a runner flow shut-off insert **52***a*. The insert **52***a* has a channel **210** in its outer surface **212** and is constructed and arranged to control flow of hardenable material **53** from an upstream portion of a feeder channel **88** to a downstream portion of the channel **88**. The insert **52***a* can be rotated to a first position, shown in FIG. **1**, that obstructs flow to one of the mold cavities **46** by obstructing flow through the feeder channel **88**. The insert **52***a* can also be rotated to a second position where the channel **210** aligns with the feeder channel **88** for permitting flow through to the mold cavity **46**. Preferably, the insert **52***a* is rotated about 90° to move between the first position, i.e. a closed position, and the second position, i.e. and open position.

3. Flow Diverter Insert

FIGS. **1**, and **16–20** illustrate flow diverter inserts **52***b* and **52***c* for controlling flow of the hardenable material **53** to a single mold cavity **48**, a pair of cavities **42** and **44**, or more than two cavities. The insert **52***b* and **52***c* has a pair of channels **214** and **216** disposed at an angle relative to each other that is rotated between a plurality of positions to divert flow to one or more mold cavities or to completely obstruct flow to any cavity.

In one preferred insert **52***b*, the insert **52***b* has one channel **214** disposed at about a 90° angle relative to another channel **216**. Referring to FIG. **1**, the insert **52***b* has a first position, an open position, where one of the channels **216** is generally aligned with the supply channel **86** and the other of the channels **214** is aligned with the feeder channel **88** that extends to the cavity **48** for permitting flow of hardenable material **53** to the cavity **48**. When the insert **52***b* rotated away from the open position, such as the closed position shown in FIG. **3**, the channels **214** and **216** are no longer aligned with channels **86** and **88** and flow is obstructed to the cavity **48**. If desired, the insert **52***b* can be indexed at specific angular increments, such as about 90° for example, such that the insert **52***b* can be moved about 90° between its open position, permitting flow, and a closed position, obstructing flow, that is disposed from the open position.

In another preferred insert **52***c*, shown in FIGS. **1**, **3**, and **16**, the insert has a pair of channels **214** and **216** arranged in a T-shape capable of controlling flow to a pair of cavities **42** and **44**. The first channel **214** extends the length of the insert **52***c* and the second channel **216** is disposed at an angle relative to the first channel **214** and intercepts the channel **214**. Preferably, the second channel **216** is disposed at about a 90° angle relative to the first channel **216**.

Referring to FIG. **16**, the cup **64'** also has channels **284**, **286** and **288**. Referring to FIG. **20**, channel **284** is aligned with channel **86**, channel **286** is aligned with channel **88**, and channel **288** is aligned with channel **88**.

Referring to FIGS. **17–20**, the insert **52***c* can be disposed in a plurality of positions for diverting flow of material **53** to either one or both cavities **42** and **44**. FIG. **17** shows the insert **52***c* disposed in a first position diverting flow to one cavity **42**. FIG. **18** shows the insert **52***c* disposed in a second position diverting flow to another cavity **44**. FIG. **19** shows the insert **52***c* in a third position diverting flow to both cavities **42** and **44**. FIG. **20** shows the insert **52***c* disposed in a fourth position obstructing flow to both cavities **42** and **44**. Preferably, the insert **52***c* is indexable in angular increments of about 90°.

While two cavities **42** and **44** are shown, the insert **52** can be constructed to distribute flow to more than two cavities, if desired. Of course, such an insert **52** would have more than four positions.

Referring to FIG. **16**, to rotate any of the inserts **52***a*, **52***b*, and **52***c*, a tool **290** engages the insert and is manually rotated while the mold **40** is open. Preferably, the tool **290** is a screwdriver. Preferably, the blade **292** of the screwdriver **290** is received in one of the channels, such as channel **214**, in the insert and the screwdriver **290** and insert are rotated in unison.

Rotating Mechanism

Each insert **50** and **52** can be carried by a rotating mechanism **54** or **66** of this invention. The rotating mechanism **54** or **66** can be constructed simply to permit the insert **50** or **52** to rotate and be positioned at any angular position, between any limits of rotation the rotating mechanism **54** or **66** may possess. Preferably, the rotating mechanism **54** or **66** is constructed to permit the insert **50** or **52** to be selectively rotated or indexed between a finite number of positions.

1. First Preferred Embodiment

FIGS. **2–6** illustrate a first preferred rotating mechanism **54** for rotatably receiving an insert, such as the aforementioned indicia-imprinting inserts **50***a*, **50***b*, or **50***c*, the runner flow shut-off insert **52***a*, the flow diverter insert **52***b* or **52***c*, or another insert. The insert is attached to or integral with the plug **56** that is received in the sleeve-like cup **64**. The cup **64** is either integral with the mold **40** or ejector pin **102** or is a separate cup **64'**, such as is shown in FIGS. **3** and **9**B, that is mounted to one end of the pin **102** or received in a pocket **218** in the mold **40**.

Referring to FIGS. **4** and **5**, the plug **56** has a head **220** that is larger than the plug body or stem **222**. The plug body or

stem **222** has a groove or thread **58** that extends about the circumference of the body **222**. As is shown in more detail in FIG. **6**, the groove **58** is open **61** at one end to permit the plug **56** to easily accept the locator or guide **240** carried by the cup **64** or **64'** so the plug **56** can be quickly and easily inserted into the cup **64** or **64'**. Conversely, this construction also enables the plug **56** to be quickly and easily removed from the cup **64** or **64'**.

An entranceway portion **60** of the groove **58** is disposed at an arcuate angle relative to a portion **62** of the groove **58** that is generally transverse to the lengthwise direction of the plug **56**. Preferably, the entranceway portion **60** is generally helical. The opening **61** in the entranceway groove portion **60** permits the plug **56** to be positively received and retained by the cup **64** or **64'**. The entranceway **60** extends in one direction to an axial end **224** of the body **222** where its opening **61** is constructed to accept the guide **240**. The entranceway groove portion **60** extends in an opposite direction to the transverse groove portion **62**. The groove portion **62** has an end wall **63** that functions as a stop to limit rotation of the plug **56**.

Preferably, the groove **58** is at least about 0.040 inches wide, preferably at least about 0.07 inches wide, and at least about 0.020 inches deep so it will accept a ball **240** of at least about 0.076 inches diameter such that the plug **56** will be retained in the cup **64** or **64'** during operation. The transverse portion **62** of the groove **56** preferably extends at least about 250° around the body **222** such that the plug can be rotated about the same amount without axially displacing relative to the cup. The transverse portion **62** preferably extends no more than about 330° around the body **222**.

The groove entrance portion **60** is acutely angled relative to the transverse groove portion **62**. Referring to FIG. **6**, the groove entrance portion **60** is angled at an angle, α, of about 30° relative to the transverse groove portion **62** for maximizing the angular range of rotation of the plug. Preferably, the groove entrance portion **60** is angled at an angle, α, of no greater than about 45° and at least about 20°. Preferably, the groove entranceway **60** extends between about 40° and about 60° around the plug body **222**. Preferably, the entranceway **60** and transverse portion **62** extend at least about two-thirds of a revolution about the body **222** and no more than about 300° about the body **222**.

The groove **58** preferably comprises is a radially inwardly extending channel of arcuate, hemispherical, triangular, square or another profile. In its preferred embodiment, the groove **58** encircles the outer periphery of the plug **56** no more than once.

Referring to FIG. **8**, the cup **64** or **64'** has a bottom wall **226**, a sidewall **228**, and an opening **230** defining a cavity **232** into which the plug **56** is received. The cavity **232** has a shape substantially complementary to the plug **56** so that when the plug **56** is inserted into the cavity **232**, its top surface is flush with the top surface of the cup **64** or **64'**. The cavity **232** has a diametrically larger portion **234** for receiving the head **220** of the plug **56** and a shoulder **235** that defines a diametrically smaller portion **236** for receiving the body **222** of the plug **56**. The cup **64** or **64'** has a radially inwardly extending guide **240** that is received in the groove **58** of the plug **56** when the plug **56** is inserted into the cavity **232**.

Referring to FIG. **5**, the inwardly extending guide **240** preferably has a contour such that it can be positively received in the groove **58** and retain the plug **56** in the cup **64'** or **64**. Preferably, the plug **56** cannot be withdrawn from the cup **64** or **64'** when the guide **240** is received in the transverse groove portion **62**. In its preferred embodiment, the guide **240** is a ball, such as a ball bearing or the like. The sidewall **228** has a bore **242** that extends from the exterior of the sidewall **228** inwardly into the cavity **232** for receiving the guide ball **240**. The width or diameter of the bore **242** preferably tapers at least slightly at its cavity end to prevent the ball **240** from passing completely through the bore **242** into the cavity **232**.

As is shown in FIG. **8**, the guide ball **240** is captured in the bore **242** by a cap **244** attached to the sidewall **228** by a bolt or screw **246** that is threaded into a threaded bore in the sidewall **228**. If desired, the cap **244** can resiliently bias the ball **240** into the cavity **232**. The cap **244** preferably is received in a recess **248** in the exterior of the cup sidewall **228**.

Referring to FIG. **5**, the ball **240** can be captured in the bore **242** by an axially extending pin **250**. The pin **250** preferably extends outwardly from the cup **64'** into a bore in the mold **40** (FIG. **3**) or into a bore **252** in the ejector pin **102** (FIG. **4**) for locating the insert and rotating mechanism while also preventing inadvertent rotation of the insert and rotating mechanism during operation.

Referring to FIG. **5**, to enable the plug **56** to be selectively rotated to specific positions during operation, a bottom shoulder **254** of the plug head **220** has a plurality of detent receivers **256** that are preferably circumferentially spaced apart around the shoulder **254**. Preferably, each detent receiver **256** comprises a notch, indention, or cutout in the shoulder **254**. To prevent the plug **56** from moving away from the selected position, the cup **64** or **64'** has a detent **258** that registers with one of the detent receivers **256**. In a preferred detent embodiment, the detent **258** comprises a detent assembly that includes a ball **258** biased by a spring **260** into the cavity **232** adjacent shoulder **235** to permit rotation of the plug **56** in the cup **64** or **64'**. Preferably, the detent assembly comprises a spring-plunger **262** threadably received in a threaded bore **264** that preferably extends axially in the cup sidewall **228** into the cavity **232**. The assembly is shown in more detail in FIGS. **9B**, **15**, and **16**.

Referring to FIGS. **7**, **8**, **9A**, and **9C**, another preferred detent assembly is shown. The detent assembly comprises a leaf spring or beam spring **266** received in a pocket **268** in the cup sidewall **228** that is secured by a screw or bolt **270** to an ejector pin **102** or the mold **40**. The leaf **266** urges the detent ball **258** into the cavity **232** while flexing slightly to accommodate rotation of the plug **56** when the position of the plug **56** is being changed. As is shown in FIG. **9A**, the detent assembly is particularly well suited for ejector pins **102** or **103**.

Where the cup **64'** is not integral with one of the mold cavities or the ejector pin **102**, the bottom wall **226** of the cup **64'** has a bore **272** through which a bolt **274** extends that is threaded into a threaded bore **276** (FIG. **15**) in the body, such as ejector pin **102**, to which the cup **64'** is mounted. So that the cup **64'** can be withdrawn from the pocket it is received, such as a pocket in the mold **40**, the diameter of the bore **272** preferably is larger than the diameter of the mounting bolt **274** to accommodate a second bolt, preferably a threaded jack screw, that is threaded into bore **272**. When threaded into bore **272**, the jack screw presses against the mold urging it away from the mold so it can be withdrawn completely out of the mold. In this manner, the cup **64'** can be tightly, frictionally fit into a pocket in the mold **40**, such as is shown in FIG. **3**, or tightly, frictionally fit into a pocket in another body.

When mounted to an ejector pin **102**, such as is shown in FIGS. **9B** and **15**, the mounting surface **278** of the pin **102**

has an upstanding flange **280** about its periphery that is coaxially received in a complementary ridge **282** in the bottom of the cup **64'**. The flange **280** and ridge **282** mate to locate the cup **64'** and therefore the insert attached to the plug **56** received in the cup **64'**.

Plug **56** is made of a material that is durable, resilient, tough, and preferably wear resistant for withstanding the demanding environment of a mold. Cup **64** or **64'** is also made of a material that is durable, resilient, tough, and preferably wear resistant. The plug **56** preferably is made of a metal, such as H13 steel, A2 steel, 420 stainless steel, 440 stainless steel, 450 stainless steel, or 455 stainless steel. Preferably, the plug **56** is made of a heat treatable stainless steel such as 420, 440, or 455 stainless steel. If desired, the plug **56** can be made of a thermoset material, a ceramic material, a brass material, aluminum, copper, or an alloy. The cup **64** or **64** preferably is made of a metal, such as H13, A2, 420 stainless steel, 440 stainless steel, 450 stainless steel, or 455 stainless steel. Preferably, the cup **64** or **64'** and is made of 455 stainless steel. If desired, the cup **64** or **64'** can be made of a thermoset material, a ceramic material, brass, aluminum, copper, or a metal or composite alloy.

2. Second Preferred Embodiment

FIGS. **2**, **7**, **9A–9C**, **11**, **13**, and **14A–14B** illustrate a second preferred rotating mechanism **66** that preferably carries an insert, such as, for example, insert **50** or **52**. The insert **50** or **52** is attached to or integral with an axially extending plug **68** that receives a flexible and resilient biasing element **70** that helps capture locator **72** in a hollow (FIG. **7**) within the plug **68**.

The plug **68** is of hollow or tubular construction and can be a tube or sleeve that preferably is generally cylindrical. The plug **68** is telescopically received in a cup **76**. The cup **76** can be integral with the mold **40** or an ejector pin **102** or **103** or is a separable component that is mounted to one end of the pin **102** or **103** or received in a pocket in the mold **40**.

The biasing element **70** preferably comprises a wad of non-metallic material that preferably is flexible and resilient. The wad **70** preferably is comprised of rubber, a rubber-like material, an elastomer, a polymer, a plastic, a nylon, a thermoplastic material, a thermoset material, or another material suitable for use in biasing locator **72** outwardly from a bore **294** in a sidewall **296** of the plug **68**.

The locator **72** preferably has a rounded surface that extends generally radially outwardly from the bore **294** (FIG. **13**) and that is received in a groove **74** in the interior surface of the cup **76** when the plug **68** is inserted into the cup **76**. While the locator **72** can comprise a pin or the like, the locator **72** preferably comprises a ball, such as a ball bearing or similar.

As is shown more clearly in FIG. **13**, the biasing element **70** is retained in the plug **68** by a retainer **298** that preferably is a screw, preferably a set screw, or a bolt that is threaded into a threaded portion of the hollow **302** (FIGS. **14A** and **14B**) in the plug **68**. In its preferred embodiment, the retainer **298** is a spring plunger that has a tip **300** that bears against the biasing element **70**. The retainer **298** is also constructed and arranged to capture both the biasing element **70** and locator **72** in the hollow **302** within the plug **68**. Together, the retainer **298** and biasing element **70** urge the locator **72** outwardly from port **294** but permit the locator **72** to be retracted, at least slightly, into the port **294** to permit the plug **68** to be quickly and easily to be inserted into and removed from the cup **76**.

To remove the locator **72**, biasing element **70** from the plug **68**, the sidewall **296** of the plug **68** has an access port **304** (FIG. **11**) to permit a tool, such as a screw driver **290**, to be inserted into the port **304**. With the retainer **298** removed, the tool **290** is inserted through the port **304** to pry free the biasing element **70** such that the biasing element **70** and locator **72** are urged out the hollow **302**.

The cup **76** has a cavity **306** into which the plug **68** is telescopically inserted. Referring to FIG. **11**, the axial end **118** of the cup **76** preferably has a recess **308** that is complementary to the head **310**, or insert **50** or **52**, carried by the plug **68** so that when the plug **68** is inserted into the cup **76**, the outer axial surface of the head **310** or insert **50** or **52** carried by the is flush or substantially flush with the outer axial surface of the cup **76**. To retain the plug **68** in the cup **76**, the cavity **306** has a generally radially outwardly extending internal groove **74** that receives the locator **72**.

As is shown more clearly in FIGS. **14A** and **14B**, the inner axial end **312** of the plug **68** has a plurality of spaced apart detent receivers **314**, each of which preferably is a notch or the like, that receives a detent **316** that preferably is a pin **316** that is received in a bore **318** that extends radially inwardly through cup sidewall **320** into the cup cavity **306**. As seen in FIG. **13**, the detent notches **314** cooperate with the detent pin **316** (FIG. **7**) to permit the plug **68**, and thereby the insert **50** or **52** carried by the plug **68**, to be selectively indexed relative to the cup **76**. Preferably, a tool, such as screwdriver **290**, is used to index the plug **68** into slot **201**. So that the plug **68** can be quickly and easily removed from the cup **76**, the cup sidewall **320** has an access port **322** through which a tool, such as screwdriver **290**, can be inserted to pry the plug **68** upwardly until it is freed. Thereafter, the plug **68** can be manually removed and another plug **68** with a different insert or the like inserted into the cup **76**.

Plug **69** is made of a material that is durable, resilient, tough, and preferably wear resistant for withstanding the demanding environment of a mold. Cup **76** is also made of a material that is durable, resilient, tough, and preferably wear resistant. The plug **68** preferably is made of a metal, such as 455 stainless steel, 440 stainless steel, 420 stainless steel, H13, A2, or another alloy. Preferably, the plug **68** is made of 455 stainless steel. If desired, the plug **68** can be made of a thermoset material, a ceramic material, brass, aluminum, copper, or a composite or synthetic material. The cup **76** preferably is made of a metal, such as H13, A2, 420 stainless steel, 440 stainless steel, 455 stainless steel, or another alloy. Preferably, the cup **68** and is made of a material that can be heat treated, nitrided, or surface hardened. If desired, the cup **76** can be made of a thermoset material, a ceramic material, brass, aluminum, copper, or a composite or synthetic material.

Use and Operation

In use, the inserts of the invention, preferably inserts **50** and **52**, are used for imprinting an indicia in material **53** in a cavity that is hardenable, or for diverting or controlling the flow of the hardenable material **53** upstream of a mold cavity. The inserts of the invention are well suited for use in molding applications, such as where plastic, metal, a polymer, or another material is the hardenable material **53** being molded. The inserts of the invention are also well suited for use in other molding applications, including applications where a metal such as steel, aluminum, titanium, copper, iron, or another metal is the hardenable material **53** being molded.

In use, the rotating mechanisms **54** and **66** of the invention are used for enabling the inserts, such as insert **50** or **52**, to

be quickly and easily rotated such that mold down time is reduced as compared to other such mechanisms and preferably minimized. Additionally, the rotating mechanisms **54** and **66** is well suited for use with inserts of a type other than indicia imprinting inserts **50** and flow-controlling or flow diverting inserts **52**.

In use, the ejector pin embodiments **102**, **102***a*, **102***b* and **102***c* of the invention are advantageously versatile in that they enable ejector pins pre-equipped with inserts, such as insert **50**, to be shipped and cut to size at another site, such as the site of the mold. By their advantageous construction, manufacturing time is reduced thereby increasing production. Moreover, by their construction, ejector pins can be cut accurately to size for the mold into which they will be used thereby taking into account any deviations in tolerance or the like that may be present in the mold thereby preventing excessive wear and minimizing or preventing clashing that might occur.

In operation, the indicia imprinting insert **50** is used to imprint an impression of two-dimensional or three-dimensional contour into the hardenable material **53** so the impression remains in the hardenable material **53** even after it has completely hardened. When mounted to an ejector pin **102** or **103**, the pin is extended outwardly from the mold **40** such that the insert **50** makes contact with the hardenable material **53** and leaves an impression in it such that the impression remains when the material **53** is hardened. As the pin **102** or **103** is further extended, it urges the material **53**, now in molded form, away from the mold cavity so it can be removed completely from the mold **40**.

To rotate or index the insert **50**, the mold **40** is opened exposing the insert **50**. A tool, preferably a screwdriver **290**, is used to engage the insert **50** and turn the insert **50** or one or more the rings of the insert **50** to the desired position. Once the desired position has been set, the mold **40** is closed and molding can begin. As a result of the detent construction previously described, the position of the insert **50** or any ring of the insert **50** will not wander during repeated cycling of the mold **40**.

The flow controlling or diverting insert **52** is used to divert or control flow of the hardenable material **53** and is typically disposed in a channel, such as runner or channel **86** and **88**, between the source of the hardenable material **90** and one or more mold cavities **42**, **44**, **46**, **48**. To change the position of the insert **52**, the mold **40** is opened and a tool **290** is used to engage and rotate the insert **52**. When the insert **52** has been rotated to the desired position, the mold **40** is closed and the mold **40** can be operated. By its advantageous construction, each insert, such as **52***a*, **52***b*, and **52***c*, is used to provide flow of hardenable material **53** only to the mold cavity where flow of hardenable material **53** is needed. Thus, for production runs where only some cavities are to be used to mold components and others are not to be used, one or more the inserts **52** are used to control flow.

In use, the first preferred rotating mechanism **54** is used to facilitate rotation of an insert, such as insert **50** or **52**. The rotating mechanism **54** preferably enables the insert to be selectively indexed to preset or predetermined positions. When rotated in one direction, the insert can be rotated until the guide **240** reaches an end, preferably an endwall, of the axial portion of the groove **58** in its outer sidewall. This end of the groove functions as a limit on the range of rotational adjustment of the rotating mechanism **54**.

When rotated in an opposite direction, the guide **240** rides in the axial portion **62** of the groove **58** until it reaches the other end of the axial portion **62**. The other end of the axial portion **62** of the groove **58** communicates with a helical or spiral portion **60** such that the guide **240** rides in the axial groove portion **62** until it reaches the helical groove portion **60**. Further rotation causes the guide **240** to ride in the helical portion **60** causing the plug **56** of the rotating mechanism **54** and insert to displace axially upwardly relative to the cup **64** in which it is received. Further rotation causes the guide **240** to ride further along the helical portion **60** until it reaches the end of the helical portion **60** and the guide **240** passes beyond the end of the helical **60** thereby completely disengaging the plug **56** from the cup **64** so it can be lifted free of the cup **64** and removed.

Thereafter, if desired, another insert carried by another rotating mechanism **54** can be inserted into the cup **64**. If desired, the insert can simply be changed and the same rotating mechanism **54** inserted into the cup **64**.

To insert the rotating mechanism **54** into the cup **64**, the plug **56** is placed in the cup cavity **232** until its axial end rests on guide **240**. The plug **56** is rotated until the guide **240** is received in the open end or entryway of the helical portion **60** of groove **62**. Further rotation causes the plug **56** to be drawn downwardly into the cup **64** by cooperation between the guide **240** and groove **58** as it rides in the helical portion **60**. Preferably, the plug **56** is rotated until the guide **240** is received in the axial groove portion **62**.

In the preferred embodiment shown, the plug **56** is rotated in a counterclockwise direction to remove the plug **56** from the cup **64** and the plug **56** is rotated in a clockwise direction to assemble the plug **56** into the cup **64**.

The second rotating mechanism **66** is rotated such that its guide, locator **72**, rides in groove **74** until the insert is located in the desired position. Detent **316** and detent notches **314** cooperate to permit the plug **68** of the mechanism **66** to be selectively indexed.

To remove the rotating mechanism **66** and insert, a tool **290** is inserted through port **322** and engages the axial end of the plug **68**. Pressure is applied using the tool **290** against the axial end of the plug **68** to urge the plug **68** and insert upwardly relative to the cup **76**. As the plug **68** is urged upwardly, the locator **72** is urged generally radially inwardly into the plug **68** against biasing element **70** such that the locator **72** clears groove **74** thereby disengaging it from the cup **76**. After the biasing element **70** has disengaged from the cup **76**, additional pressure causes the plug **68** to move farther axially upwardly relative to the cup **76** until the plug **68** can be manually lifted free of the cup **76**.

To insert the rotating mechanism **66** into the cup **76**, the plug **68** is placed into the cup cavity **306** such that its sidewall **296** is slidably, telescopically received in the cup **76**. Pressure is applied to the outer surface **198** of the insert to urge the plug **68** farther into the cavity **306**. By applying pressure, the locator **72** is urged inwardly against biasing element **70** into the plug **68** by the interior sidewall of the cup **76**. When received in the groove **74** in the interior sidewall of the cup **76**, the locator **72** is urged outwardly by the biasing element **70** thereby engaging the locator **72** with the cup **76**. When the locator **72** is engaged with the cup **76** by being received in its groove **74**, the plug **68** can be rotated but cannot be axially displaced.

It is also to be understood that, although the foregoing description and drawings describe and illustrate in detail preferred embodiments of the present invention, to those skilled in the art to which the present invention relates, the present disclosure will suggest many modifications and constructions as well as widely differing embodiments and applications without thereby departing from the spirit and

scope of the invention. The present invention, therefore, is intended to be limited only by the scope of the appended claims.

What is claimed is:

1. An insert that is disposed in a mold that includes a pair of mold halves that define a mold cavity when the mold halves are disposed together in a closed position, the insert comprising:

(a) a plug having an outer axial face that is exposed toward one the mold halves when the mold halves are disposed in the closed position, the plug having a body and an axis about which it can rotate, the outer axial face contoured to affect a hardenable molding material comprising one of a metal, a plastic or a polymer;

(b) a plug receiver disposed in another one of the mold halves and having a cavity therein having an opening at one end of the plug receiver through which the plug is inserted;

(c) (1) a groove in one of the plug and the plug receiver that encircles the periphery of the plug and which is comprised of (i) a single circumferential band portion that does not extend completely around the periphery of the plug and that is generally perpendicular to the axis of plug rotation, and (ii) a helical entranceway portion disposed at an angle relative to the circumferential band portion and which connects with the circumferential band portion, and (2) a locator that extends from the other one of the plug and the receiver and that (i) is received in the entranceway portion of the groove during assembly of the plug to the plug receiver, (ii) is received in the circumferential band portion of the groove when the plug is received in the plug receiver, and (iii) prevents removal of the plug from the plug receiver when the plug is received in the plug receiver and the locator is disposed in the circumferential band of the groove, and

(d) a rotation resisting element carried by one of the plug and the plug receiver that contacts the other one of the plug and the plug receiver that resists rotation of the plug when the plug is disposed in the cavity in the plug receiver.

2. The insert of claim **1** wherein the plug receiver has a sidewall that defines the cavity and an interior sidewall surface wherein the locator extends radially inwardly from the interior sidewall surface into the cavity and the groove is formed in the plug.

3. The insert of claim **2** wherein

(a) the plug comprises a body and a head that is larger than the body defining, a downturned shoulder therebetween,

(b) the cavity is defined by a first sidewall and a second sidewall defining an upturned shoulder therebetween,

(c) wherein the rotational resisting element comprises a plurality of spaced apart detent receivers disposed in one of the upturned shoulder and the downturned shoulder and a detent carried by the other one of the upturned shoulder and the downturned shoulder that opposes rotation of the plug relative to the plug receiver when the plug is received in the plug receiver and the detent is received in one of the detent receivers.

4. The insert of claim **1** wherein the groove has an arcuate cross sectional contour and the locator has a rounded end that is received in the groove when the plus is disposed in the plug receiver.

5. The insert of claim **4** wherein the groove is at least about 0.04 inches wide and at least about 0.02 inches deep, and the rounded end of the locator has a diameter of at least about 0.076 inches.

6. The insert of claim **1** wherein the groove has only a single entranceway portion of the groove.

7. The insert of claim **1** wherein the groove extends no more than about one and one-half times around the periphery of the plug.

8. The insert of claim **1** wherein the circumferential band portion of the groove extends at least about 250° around the periphery of the plug.

9. The insert of claim **6** wherein the groove has a depth of at least about 0.020 inches.

10. The insert of claim **9** wherein the groove has a width of at least about 0.040 inches.

11. The insert of claim **6** wherein the groove has a curvilinear cross-sectional contour.

12. The insert of claim **1** wherein the plug receiver has a bore and the locator comprises a ball received in the bore and which has a portion that extends outwardly into the cavity and wherein the portion of the ball that extends outwardly into the cavity is received in the groove to permit the plug to rotate relative to the plug receiver while limiting axial motion of the plug relative to the receiver.

13. The insert of claim **12** wherein the ball is retained in the bore by a plate removably attached to the plug receiver.

14. The insert of claim **12** wherein the receiver comprises a cup that is removably attached to the mold by a fastener.

15. The insert of claim **12** wherein the receiver comprises a cup and the cup is removably attached to an ejector pin that operably cooperates with the mold.

16. The insert of claim **15** wherein the cup is removably attached to the ejector pin by a fastener.

17. The insert of claim **12** wherein the receiver comprises a cup and the plug and cup are received in a pocket in a cavity in the mold and the axially outer face of the plug comprises an indicia embossing surface for affecting the hardenable molding material by leaving an impression in the hardenable material received in the mold cavity when the hardenable material hardens.

18. The insert of claim **12** wherein 1) the mold has a cavity therein for receiving the hardenable material therein from a source of the hardenable material, 2) the receiver comprises a cup that is received in a pocket in the mold, 3) the axially outer face of the plug has a channel therein, 4) wherein the plug i) is rotated to an open position to affect the hardenable material by permitting flow of the hardenable material from the source through the channel to the cavity in the mold, and ii) is rotated a closed position disposed from the open position to to affect the hardenable material by impeding flow of the hardenable material from the source through the channel and to the cavity in the mold.

19. The insert of claim **1** wherein the insert is carried by an ejector pin comprised of 1) bar stock that forms a barrel that is hardened and that is cut to length and 2) a head that has a larger diameter than the barrel that is attached to the barrel after the barrel has been hardened and cut to length.

20. An insert assembly for a mold comprising:

a first plug having 1) a first outer axial face that is contoured to affect a hardenable material by causing an indicia to be embossed directly into the hardenable material, and 2) a cavity in the outer axial face;

a receiver having a cavity therein for receiving the first plug;

a second plug received in the cavity in the first plug and having a second outer axial face that is contoured to affect a hardenable material by causing indicia to be embossed directly into the hardenable material;

wherein the hardenable material comprises one of a plastic and a polymer;

wherein a) one of the plugs has a generally cylindrical body that comprises 1) an outer sidewall with a radially extending bore that connects with an axially extending hollow therein, 2) a biasing element that is comprised of a non-metallic material and which is disposed in the axially extending hollow, and 3) a locator disposed in the bore that is urged outwardly by the biasing element such that a portion of the locator extends outwardly from the outer sidewall, and b) the cavity of the receiver in which the one of the plugs is received is defined by an interior sidewall that has a channel therein that receives the locator when the one of the plugs is disposed in the cavity; and

wherein a) the other one of the plugs has a generally cylindrical body that comprises an outer sidewall with a channel in its exterior with the channel 1) having a first portion i) that is transverse to an axis of rotation of the other one of the plugs and ii) which extends no more than 360° around the outer sidewall, and 2) having a second portion that is inclined at an acute angle relative to the first portion of the channel, b) the receiver in which the other one of the plugs is received has a guide in its cavity that extends outwardly into the cavity and which is received in the channel when the other one of the plugs is disposed in the cavity, and c) wherein the other one of the plugs is rotatable without axial displacement when the other one of the plugs is disposed in the cavity and the guide is disposed in the first portion of the channel.

21. An insert for a mold having a pair of mold halves and an ejector pin comprising:

a rotatable plug having a head at one end with an axially outer face, a generally cylindrical body that has a free end at an opposite end, that is diametrically smaller than the head, and that has a groove therein that 1) is of arcuate cross section, 2) has a transverse portion that is perpendicular to a longitudinal axis of rotation of the plug and that extends no more than 360 degrees around the cylindrical body and 3) has an entranceway portion i) that is inclined relative to the transverse portion, ii) that leads to the transverse portion, and iii) that extends adjacent the free end of the plug body, and a shoulder formed where the head and body adjoin;

a fixed receiver having a cavity therein for receiving the plug with the cavity defined by a sidewall that has a radial shoulder disposed inside the cavity that divides the cavity into a first portion for receiving the head of the plug and a second portion that is diametrically smaller than the first portion for receiving the body of the plug;

a ball carried by the sidewall and disposed in a generally radially extending bore in the sidewall, wherein a portion of the ball is received in the groove when the plug is received in the cavity to permit the plug to rotate relative to the receiver while opposing axial motion of the plug relative to the receiver when the portion of the ball that is received in the groove is received in the transverse portion of the groove;

a detent assembly that permits the plug to be selectively indexed, the detent assembly comprising an axially extending spring plunger that is at least partially disposed in the radial shoulder of the receiver and that includes a ball that has at least a portion that extends from the radial shoulder of the receiver outwardly into the cavity and bears against the shoulder of the plug when the plug is received in the cavity of the receiver to oppose rotation of the plug relative to the receiver; and

a fastener that removably attaches the receiver to one of the mold halves or the ejector pin.

22. The insert of claim **4** wherein the detent comprises an outwardly biased detent ball that is carried by the plug receiver and each detent receiver comprises a notch in the downturned shoulder of the plug wherein the detent ball opposes rotation of the plug relative to the plug receiver when the plug is received in the plug receiver and the detent ball is received in one of the notches.

23. The insert of claim **22** wherein the detent ball is biased outwardly by a spring plunger that has a longitudinal axis disposed generally parallel to the axis of rotation of the plug.

24. The insert assembly of claim **20** further comprising a retainer that engages the body of the one of the plugs to prevent removal of the biasing element from the hollow in the body of the one of the plugs and wherein the biasing element comprises a generally cylindrical wad of an elastomeric material.

25. The insert assembly of claim **20** further comprising a detent in the cavity in which the one of the plugs is received, wherein the outer sidewall of the one of the plugs has an axial end with a plurality of detent receivers and the detent is received in one of the detent receivers when the one of the plugs is received in the cavity to oppose rotation of the one of the plugs.

26. The insert assembly of claim **20** further comprising a third outer axial face that is contoured to affect a hardenable material by causing an indicia to be embossed into the hardenable material wherein the third outer axial face surrounds the first outer axial face and the second outer axial face.

27. The insert assembly of claim **20** wherein both of the plugs are carried by an ejector pin and are disposed at one end of the ejector pin.

28. An insert assembly for a mold comprising:

a first plug having 1) a first outer axial face that is contoured to affect a hardenable material by embossing an indicia into the hardenable material, and 2) a cavity in the outer axial face;

a receiver having a cavity therein for receiving the first plug;

a first rotating mechanism that operably cooperates with the first plug and the receiver to permit the first plug to be rotated relative to the mold;

a second plug received in the cavity in the first plug and having a second outer axial face that is contoured so as to affect a hardenable material by embossing an indicia into the hardenable material;

a second rotating mechanism that operably cooperates with the second plug and the first plug to permit the second plug to be rotated relative to the first plug;

wherein the hardenable material comprises one of a plastic and a polymer; and

wherein a) one of the plugs has a generally cylindrical body that comprises an outer sidewall with a channel in its exterior with the channel 1) having a first portion i) that is transverse to an axis of rotation of the one of the plugs and ii) which extends no more than 360° around the outer sidewall, and 2) having a second portion that is inclined at an acute angle relative to the first portion of the channel, b) the receiver in which the one of the plugs is received has a guide in its cavity that extends

outwardly into the cavity and which is received in the channel when the one of the plugs is disposed in the cavity, and c) wherein the one of the plugs can be rotated without axial displacement when the one of the plugs is disposed in the cavity and the guide is disposed in the first portion of the channel.

29. The insert assembly of claim **28** wherein the ball and groove comprise one of the first and second rotating mechanisms.

30. An insert that is disposed in a mold that includes a pair of mold halves, at least one of which defines a mold cavity, the insert comprising:

(a) a plug having an axial face that is exposed toward one of the mold halves when the mold halves are disposed in a closed position, the plug having a generally cylindrical body and an axis about which the plug can rotate, the axial face three dimensionally contoured so as to affect hardenable molding material comprising a plastic or a polymer, the body having an outer wall that includes a groove that extends no more than one and one half times around the periphery of the body, the groove comprising a transverse portion that extends no more than a single time around the body and which is generally perpendicular to the axis about which the plug can rotate, and the groove comprising an entranceway portion that is disposed at an acute angle relative to the transverse portion that leads to the transverse portion;

(b) a pocket in which at least the body of the plug is received, the pocket defined by a sidewall that includes a locator that is received in the groove when the body of the plug is received in the pocket;

(c) wherein the axial face of the plug remains substantially planar during rotation of the plug when the locator is disposed in the transverse portion of the groove; and

(d) further comprising a cup that has a recess that defines the pocket and wherein the cup is removably received in a receptacle in one of the mold halves.

31. The insert of claim **30** wherein the plug further comprises a head that is larger than the body defining a shoulder therebetween wherein the shoulder of the head includes a plurality of detent notches and the sidewall of the pocket further comprises a detent that registers with one of the detent notches of the head of the plug to resist rotation of the plug.

32. The insert of claim **31** wherein the sidewall that defines the pocket comprises a shoulder against which the shoulder of the head of the plug abuts when at least the body of the plug is received in the pocket and detent comprises a spring plunger that includes a ball that has at least a portion that extends outwardly from the shoulder of the sidewall that defines the pocket into the pocket.

33. The insert of claim **30** wherein the plug is disposed in the mold cavity and the axial face is three dimensionally contoured with indicia that is embossed or imprinted into the hardenable material.

34. The insert of claim **33** further comprising an ejector pin that has a barrel that is cut to axial length and attached by a fastener to a head of the ejector pin that is larger in width than the barrel.

35. The insert of claim **30** wherein the axial face of the plug further comprises a hardenable material flow channel.

36. The insert of claim **30** wherein the groove is at least 0.040 inches wide, at least 0.20 inches deep, the transverse portion of the groove extends between as much as 330° around the body of the plug, and the entranceway portion extends between 40° and 60° around the body of the plug and is disposed at an angle of between 20° and 40° relative to the transverse portion of the groove.

37. The insert of claim **36** wherein the transverse portion of the groove and the entranceway of the groove together extend no more than about 300° around the body.

38. An insert that is disposed in a mold that includes a pair of mold halves, at least one of which defines a mold cavity, the insert comprising:

(a) a plug having an axial face that is exposed toward one of the mold halves when the mold halves are disposed in a closed position, the plug having a generally cylindrical body and an axis about which the plug can rotate, the axial face being three dimensionally contoured so as to affect a hardenable molding material comprising a plastic or a polymer, the body having a sidewall that defines a hollow therein and which has a bore therethrough, a locator disposed in the bore, and a non-metallic biasing element disposed in the hollow that urges the locator outwardly from the sidewall;

(b) a pocket in which at least the body of the plug is received, the pocket defined by a sidewall that includes a groove that has a portion transverse to the axis of rotation of the plug that does not extend completely around the periphery of the sidewall, the groove receiving the locator when the body of the plug is received in the pocket, the groove including a helical entranceway portion that permits the locator to register with the groove during assembly of the body of the plug into the pocket; and

(c) wherein the axial face of the plug remains substantially planar during rotation of the plug when the locator is disposed in the transverse portion of the groove.

39. The insert of claim **38** wherein the pocket is disposed in one of the mold cavities.

40. The insert of claim **39** wherein the pocket defined by a plug receiver that is removably received in a bore in one of the mold cavities.

41. The insert of claim **38** further comprising a retainer that engages the body of the plug to prevent removal of the biasing element from the hollow in the plug and wherein the biasing element comprises a generally cylindrical wad of an elastomeric material.

42. The insert of claim **38** further comprising a detent in the pocket in which the plug is received, wherein the outer sidewall of the plug has an axial end with a plurality of detent receivers and the detent is received in one of the detent receivers when the plug is received in the pocket to oppose rotation of the plug.

43. An insert disposed in a mold that includes a mold cavity, the insert comprising:

(a) a plug having an axial face that is exposed to a hardenable molding material that flows into the mold cavity, the plug having a body and an axis about which it can rotate, the axial face contoured so as to affect the hardenable molding material;

(b) a plug receiver disposed in the mold, the plug receiver having a plug-receiving cavity therein;

(c) (1) a groove in one of the plug and the plug receiver that encircles the plug and which includes (i) a single circumferential band portion that does not extend completely around the plug and that is transverse to the axis of plug rotation, and (ii) an entranceway portion disposed at an angle relative to the circumferential band portion of the groove and which connects with the

circumferential band portion of the groove, (2) a locator that extends from the other one of the plug and the receiver and that (i) is received in the entranceway portion of the groove when the plug is being inserted the plug receiver, (ii) is received in the circumferential band portion of the groove when the plug has been inserted into the plug receiver, and (iii) opposes removal of the plug from the plug receiver when the plug is received in the plug receiver and the locator is disposed in the circumferential band of the groove, and (3) wherein the groove has an arcuate cross sectional contour and the locator has a rounded end that is received in the groove when the plug is disposed in the receiver.

44. The insert of claim **43** wherein the groove is at least 0.04 inches wide and at least 0.02 inches deep, and wherein the rounded end of the locator is round and has a diameter at least 0.076 inches.

45. The insert of claim **43** wherein the groove has only a single entranceway portion of the groove and the entranceway portion of the groove is helical.

46. The insert of claim **43** wherein the groove extends no more than about one and one-half times around the periphery of the plug.

47. The insert of claim **46** wherein the circumferential band portion of the groove extends at least about 250° around the periphery of the plug.

48. The insert of claim **43** wherein the plug receiver has a bore and the locator comprises a ball received in the bore and which has a portion that extends into the plug-receiving cavity and wherein the portion of the ball that extends into the plug-receiving cavity is disposed in the groove to permit the plug to rotate relative to the plug receiver while opposing axial motion of the plug relative to the plug receiver.

49. The insert of claim **48** wherein the plug receiver comprises a cup and the plug and cup are received in a pocket in a cavity in the mold and the axially outer face of the plug comprises an indicia embossing surface for affecting the hardenable molding material by leaving an impression in the hardenable material received in the mold cavity when the hardenable material hardens.

50. The insert of claim **48** wherein 1) the mold cavity receives hardenable material therein from a source of the hardenable material, 2) the receiver comprises a cup that is received in a pocket in the mold, 3) the axially outer face of the plug has a channel therein, 4) wherein the plug i) is rotated to a first position that affects hardenable material by permitting flow of hardenable material from the source of the hardenable material through the channel toward the mold cavity, and ii) is rotated to a second position that affects the hardenable material by impeding flow of the hardenable material into the cavity in the mold.

51. An insert disposed in a mold that includes a mold cavity, the insert comprising:

(a) a plug having an end that is exposed to a hardenable molding material, the plug having a body and an axis about which it can rotate, the exposed end of the plug contoured so as to affect the hardenable molding material;

(b) a plug receiver disposed in the mold, the plug receiver having a plug-receiving cavity therein;

(c) (1) a groove in one of the plug and the plug receiver that encircles the plug and which includes (i) a single circumferential band portion that does not extend completely around the plug and that is transverse to the axis of plug rotation, and (ii) an entranceway portion disposed at an angle relative to the circumferential band portion of the groove and which connects with the circumferential band portion of the groove, and (2) a locator that extends from the other one of the plug and the receiver and that (i) is received in the entranceway portion of the groove when the plug is being inserted the plug receiver, (ii) is received in the circumferential band portion of the groove when the plug has been inserted into the plug receiver, and (iii) opposes removal of the plug from the plug receiver when the plug is received in the plug receiver and the locator is disposed in the circumferential band of the groove; and

(d) a ball received in a bore in one of the plug and the plug receiver with a portion of the ball extending from the one of the plug and the plug receiver that is received in the groove when the plug is received in the plug receiver.

52. The insert of claim **51** wherein the groove extends no more than about one and one-half times around the periphery of the plug.

53. The insert of claim **51** wherein the circumferential band portion of the groove extends at least about 250° around the periphery of the plug.

54. The insert of claim **51** wherein the ball has a portion that extends into the plug-receiving cavity and wherein a portion of the ball that extends into the plug-receiving cavity is received in the groove to permit the plug to rotate relative to the plug receiver while limiting axial motion of the plug relative to the plug receiver.

55. The insert of claim **51** wherein the receiver comprises a cup that is removably attached to the mold by a fastener.

56. The insert of claim **51** wherein the receiver comprises a cup and the cup is removably attached to an ejector pin that operably cooperates with the mold.

57. The insert of claim **51** wherein the insert is carried by an ejector pin comprised of 1) bar stock that forms a barrel that is hardened and that is cut to length and 2) a head that has a larger diameter than the barrel that is attached to the barrel after the barrel has been hardened and cut to length.

* * * * *